BLM LIBRARY
88071710

FEMA 310
Seismic Evaluation of Buildings

Boise District Office Building
Boise, Ada County, Idaho

Prepared for: U.S. Bureau of Land Management

Prepared by:
Thomas C. Graber, P.E.
Bureau of Reclamation

Date: September 1999

TH
439
.G73
1999

LIBRARY
JAN 2 0 2000
Bureau of Reclamation
Reclamation Service Center

DATE DUE

JUL 2 6 2001
IL: 9116165

GAYLORD
PRINTED IN U.S.A.

TH #43320399
439
.G73
1999
c.1

088071710

c.1

TH
439
.G73
1999

Signature Sheet

T. C. Graber
Evaluator, Thomas C. Graber, P.E.
Structural Engineer, D8120

9-17-99
Date

R. Barthel
Checked, Rodney J. Barthel, P.E.
Structural Engineer, D8110

9-20-99
Date

R. Barthel
Peer Review, Rodney J. Barthel, P.E.
Structural Engineer, D8110

9-20-99
Date

Olaff G. Huerta
FOR: Approved, John R. Baals, P.E.
Interior Seismic Safety Coordinator
Structural Engineer, D8110

9-21-99
Date

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

Contents

1.0 Scope and Limitations 1

2.0 Introduction 3

3.0 Site and Building Data 3
  3.1 General Building Description 3
  3.2 Structural and Non Structural System 4
    3.2.1 Roof 4
    3.2.2 Ceiling 4
    3.2.3 Floor 4
    3.2.4 Walls 4
    3.2.5 Foundation 4
    3.2.6 Adjacency 5
    3.2.7 Lateral-Force-Resisting System 5

4.0 Parameters 6
  4.1 Performance Level 6
  4.2 Soil Parameters 6
  4.3 Region of Seismicity 6
  4.4 Building Occupancy 7
  4.5 Historic Significance 7
  4.6 Risk Analysis Demand-to-Capacity Ratio 8

5.0 Assumptions 8
  5.1 Tier 1 Material Strengths 8
    5.1.1 Structural Steel Strength 8
    5.1.2 Bolt Strength 8
  5.2 Tier 2 Material Strengths 8
    5.2.1 Structural Steel and Bolt Strengths 9
    5.2.2 Weld Strength 9

6.0 Tier 1 Screening Phase 9
  6.1 Geologic Site Hazard and Foundation Checklist 9
    6.1.1 Geologic Site Hazards 9
      6.1.1.1 Liquefaction 9
    6.1.2 Condition of Foundations 10
      6.1.2.1 Foundation Performance 10
  6.2 Basic Nonstructural Checklist 10
    6.2.1 Ceiling Systems 10
      6.2.1.1 Lay-In Tiles 10
      6.2.1.2 Support 10
    6.2.2 Light Fixtures 11
      6.2.2.1 Independent Support 11
    6.2.3 Cladding and Glazing 11
      6.2.3.1 Glazing 11
    6.2.4 Masonry Veneer 12
      6.2.4.1 Shelf Angles 12
      6.2.4.2 Ties 12

Contents (Continued)

            6.2.4.3 Weakened Planes 12
        6.2.5 Building Contents and Furnishings 13
            6.2.5.1 Tall Narrow Contents 13
    6.3 Supplemental Nonstructural Checklist 13
    6.4 Basic Structural Checklist 13
        6.4.1 Steel Braced Frames 15
            6.4.1.1 Building System 15
                6.4.1.1.1 Weak Story 15
            6.4.1.2 Lateral Force Resisting System 15
                6.4.1.2.1 Axial Stress Check 15
                6.4.1.2.2 Redundancy 16
    6.5 Supplemental Structural Check List 16

7.0 Deficiency-Only Tier 2 Analysis 16
    7.1 Linear Static Procedure 17
        7.1.1 Loading 17
        7.1.2 Modeling 17
        7.1.3 Acceptance Criteria 18
        7.1.4 Steel Braced Frames 19
            7.1.4.1 Building System 19
                7.1.4.1.1 Weak Story 19
            7.1.4.2 Lateral-Force-Resisting System 20
                7.1.4.2.1 Axial Stress Check 20
                7.1.4.2.2 Redundancy 20
        7.1.5 Demand-to-Capacity Ratios 21

8.0 Tier 3 Detailed Evaluation Phase 21

9.0 Deficiencies And Mitigation Recommendation 21
    9.1 Foundation And Geologic Site Hazard 22
    9.2 Non-Structural 22
    9.3 Structural 23

10.0 Cost of Mitigation 23
    10.1 Structural 23
    10.2 Foundation and Geologic 23
    10.3 Non-Structural 24
    10.4 Finishing 24

11.0 References 25

Appendices

Appendix A -- Photos & Figures
Appendix B -- RVS Form and Supplemental Data
Appendix C -- Screening Phase Check Lists (Tier 1)
Appendix D -- Screening Phase Calculations (Tier 1)
Appendix E -- Evaluation Phase Calculations (Tier 2)
Appendix F -- Detailed Evaluation Phase Calculations (Tier 3)
Appendix G -- Mitigation
Appendix H -- Cost Estimate

1.0 Scope and Limitations

The results of this seismic evaluation are not intended to be used for design or rehabilitation construction purposes. The tiered structural analyses and checklists (e.g., structural, nonstructural, geologic site hazards, and foundations) contained in this report were performed solely for the purpose of verifying the presence of seismic-related deficiencies. The engineering evaluations and judgments expressed herein are limited to addressing the checklists and tiered analysis approach of the FEMA 310 [1][1] evaluation process (Handbook). Furthermore, the conceptual rehabilitation options presented in this report are not the only feasible options and should not eliminate other viable options from consideration. As a result, this report will deal only with major cost issues needed for the building to exhibit an acceptable, pre-established performance level. It will not address the more complete and detailed analyses and designs required in a rehabilitation design document, such as the FEMA 273 [2].

This seismic evaluation is an engineering document prepared by a design professional to address the goals presented above. In an attempt to expand the potential uses of the document by a non-engineering audience of building owners and managers, budget office personnel, and others responsible for the safe operation of the building, the following summary of the evaluation process is provided.

The FEMA 310 process is a three-tiered evaluation process that allows a trained design professional to identify potential seismic deficiencies in a building or structure, as related to structural, nonstructural, geologic site hazards, and foundation conditions. Tier 1 is a screening phase, Tier 2 is an evaluation phase, and Tier 3 is a detailed evaluation phase. A building, or any of its components, is considered seismically deficient if it does not comply with the provisions of the Handbook. For instance, components in a building's lateral-force-resisting system that could yield or fail under the predicted earthquake loadings may be identified as deficient through the evaluation process.

The Tier 1 evaluation identifies potential deficiencies through the use of "quick" checklist statements. The Tier 2 evaluation requires a complete, linear elastic analysis of the building to address all of the deficiencies identified in the Tier 1 evaluation. If deficiencies are identified during a Tier 2 evaluation, the design professional may choose either to conclude the evaluation and report the deficiencies or proceed to Tier 3 and conduct a detailed seismic evaluation. The process, as applied herein, then allows for the design professional to recommend conceptual seismic rehabilitation measures, and associated cost estimates, for building components found to be deficient. In this regard, the FEMA 310 process identifies any potential weak links in the structure and addresses conceptual rehabilitation measures and associated costs required to meet the desired performance level.

---

[1] Brackets [ ] indicate reference numbers.

The FEMA 310 process requires the building being evaluated to meet one of two levels of building performance, referred to as Life Safety and Immediate Occupancy. The Life Safety performance level is a building performance that includes significant damage to both structural and nonstructural components during a design earthquake, though at least some margin against either partial or total structural collapse remains. Injuries may occur, but the level of risk for life-threatening injury and entrapment is low. The Immediate Occupancy performance level is a building performance that includes very little damage to both structural and nonstructural components during a design earthquake. The basic vertical and lateral-force-resisting systems retain nearly all of their pre-earthquake strength and stiffness. The level of risk for life-threatening injury as a result of damage is low. Although some minor repairs may be necessary, the building is fully habitable after a design earthquake, and the needed repairs may be completed while the building is occupied.

The design professional and the authority having jurisdiction over the building shall determine the level of performance desired. The performance level determined for historic structures must provide both safe egress and a level of structural protection that will preserve the valuable structure or at least minimize repairs following a design earthquake.

One of the first steps in the FEMA 310 process is to classify the structure as one of 15 common building types (CBT). The CBTs are standard designations that capture most of the common building structural configurations, such as reinforced masonry, wood light frame, or reinforced concrete. A more detailed description of each CBT can be found in FEMA 310, Section 2.6, Table 2-2.

A set of basic and supplemental structural checklists, customized for the particular CBT, is completed during the Tier 1 evaluation of the FEMA 310 process. The use of specific checklists is triggered by parameters such as the region of seismicity and level of performance. The CBT checklists address the structural issues for the building. Basic and supplemental nonstructural, geologic site, and foundations issues are also addressed in separate checklists. The checklists, which are usually completed on-site during the inspection process, focus on the issues required for the desired level of building performance. The design professional answers each of the evaluation statements with a compliant (C), non-compliant (NC), or not applicable (N/A) response. A NC answer to any evaluation statement indicates a potential seismic deficiency, and the engineer must then further analyze that particular issue to determine if a deficiency exists. When deficiencies relating to structural, non-structural, geologic site hazards, or foundations conditions are confirmed, a conceptual repair scheme and appraisal-level cost estimate are generally provided as part of the report.

2.0 Introduction

The building is the Boise District Office for the Bureau of Land Management (BLM) and is located at 3948 Development Avenue, Boise, ID 83705 (See Appendix A, Figure No. 1). A site visit and field inspection of the structure was conducted on August 25, 1999 by Tom Graber of the Bureau of Reclamation (BOR). The field contacts were Ms. Shelley Cooper (208) 384-3424 and Mr. John Ryan, (208) 384-3419 of the BLM.

The Rapid Visual Screening (RVS) [3] Form and supplemental data are provided in Appendix B. No destructive testing or material testing was used on the facility during the evaluation.

3.0 Site and Building Data

3.1 General Building Description

The building was designed in 1978 and constructed in 1980. The building is a braced steel frame in both the transverse direction and longitudinal direction. The building consists of two distinct sections. The first section is a one-story section on the south side of the building. This section is approximately 84-feet long by 56-feet wide. The floor area of the single-story section is 4,700 square feet. This section of the building is referred to as Building Section 1 throughout this report. The second section is the two-story high portion located on the north side of the building. This section is approximately 168-feet long by 72-feet wide. The total floor area of the two-story section is 24,190 square feet. This section of the building is referred to as Building Section 2 throughout this report. The floor-to-floor story height of Building Section 2 is 12-feet 8-inches for both stories. The overall building height from the base to top of the roof parapet of Building Section 1 is 15-feet 0-inches. The overall building height from the base to top of the roof parapet of Building Section 2 is 27-feet 8-inches.

Structural member sizes and connection details were obtained from the original specification drawings provided by BLM. Random details and member sizes were confirmed during the site visit. Drawings used for this report are shown in Appendix A, Figure Nos. 2 through 24. General and structural notes are located on Structural Drawing S1 (Figure No. 14). A 1986 geotechnical investigation report for the warehouse and maintenance building located adjacent to the office building site was also provided by BLM (See Appendix B). This report was used to determine the soil type at the site.

3.2 Structural and Non Structural System

3.2.1 Roof

The roof has a minimal slope. The roof consists of a metal deck with insulation, a built-up roof and gravel surfacing. The roof decking is 1 1/2-inch-deep by 18 gage steel roof deck. The insulation is 4-inch thick rigid board insulation. The depth of the gravel surfacing is approximately 3-inches. The depth of the gravel is not shown on the drawings and was determined by field measurement. The roof decking is supported on intermediate roof beams that transmit roof loads to the transverse braced frames. The decking is welded or button punched between sheets to provide a diaphragm shear capacity of 375 pounds per lineal foot. Roof beam sizes are shown on the drawings. See Appendix A, Figure Nos. 6, 14, 15 and 16 and Photo No. 6 for details.

3.2.2 Ceiling

There are suspended T-bar acoustical panel ceilings in the majority of the building. The ceilings of the restrooms, mechanical equipment rooms, and others are gypsum board on metal studs. See Appendix A, Figure Nos. 5, 6, 11, and 12 and Photo Nos. 7, 8, 10, 11, 12 for details.

3.2.3 Floor

The first floor is a concrete slab-on-ground. The second floor is a composite section consisting of a 1 1/2-inch by 18ga. composite steel deck with 2 1/2-inches of normal weight concrete for a total depth of 4-inches. See Appendix A, Figure Nos. 14 and 15 for details.

3.2.4 Walls

The exterior walls are 4-inch thick face brick attached to a 6-inch deep metal stud wall. The stud wall has 1/2-inch plywood sheathing on the outside and 5/8-inch gypsum board on the inside. The wall is insulated with batt insulation. A description of the columns is discussed in report Section 3.2.7. See Appendix A, Figure No. 7 for details.

3.2.5 Foundation

The structural steel columns are supported on isolated pad and stem reinforced concrete foundations. A reinforced concrete beam connects the pair of footings at the braced frame locations. The foundations are not visible due to floor coverings. There is no evidence of foundation cracking or differential settlement around the outside of the building or in the first floor slab-on-ground. See Appendix A, Figure Nos. 14, 17 and 18 for details.

3.2.6 Adjacency

During past earthquakes, it has been noted that the collision, known as "structural pounding", between adjacent buildings during a seismic event has contributed to structural and/or cosmetic damages. When the story levels of two adjacent buildings are at the same elevations, damages due to the pounding effect are generally cosmetic. However, when the story levels of adjacent buildings are at different elevations the floors of each structure can act as rams, which can batter structural elements of other building. Additionally, when one of the buildings is taller than the adjacent building, the lower building can act as a base for the upper part of the higher building. The lower building is subjected to an unexpected lateral force, and the taller building is subjected to a stiffness discontinuity at the level of the top of the lower building.

Per FEMA 310, Section 4.3.1.2, a neighboring structure is considered to be "immediately adjacent" if it is within 4% of the height away from the adjacent structure (0.04 x 10-feet x 12-inches/foot = 4.8-inches).

There is no additional structure located adjacent to the subject building being evaluated. However, Building Section 1 is constructed integrally with Building Section 2. The roof diaphragm of Building Section 1 is nearly coincident with the second floor of Building Section 2 and, therefore, ramming is not anticipated. Due to roof level elevation differences between the two building sections, the stiffness discontinuity condition may be a consideration.

3.2.7 Lateral-Force-Resisting System

Per FEMA 310, Section 2.6, the second floor of Building Section 2 is designated as a Common Building Type S2--Steel Braced Frames with Rigid Diaphragms in both directions. The second floor diaphragm is considered rigid based on criteria presented in the "Design of Low-Rise Concrete Buildings for Earthquake Forces" [4].

Per FEMA 310, Section 2.6, the roofs of Building Section 2 and Building Section 1 are designated as a Common Building Type S2A--Steel Braced Frames with Flexible Diaphragms in both directions.

The lateral-force-resisting system for both building sections consists of braced frames in both orthogonal building directions. The braced frames are comprised of steel pipe columns, structural steel wide flange (W) beams and steel pipe braces. See Appendix A, Photo Nos. 7, 8, and 9 and Figure Nos. 15, 16, and 19 thru 24 for braced frame member sizes and connection details.

Structural connections are made with 3/4-inch diameter, ASTM A325-X bolts (See Appendix A, Figure No. 14, "Structural Notes", "Design Stresses"). The grade of welding electrode used for the structural steel connections is not specified on the drawings.

4.0 Parameters

4.1 Performance Level

FEMA 310, Section 2.4, indicates that a desired level of performance shall be defined prior to conducting a seismic evaluation using the Handbook. The level of performance was determined by the authority having jurisdiction. The structural and nonstructural components of the building must resist forces for a Live Safety (LS) performance level per a telephone conversation with the BLM Seismic Coordinator, Ms. Lydia Creager (303) 987-6855 on August 18, 1999.

4.2 Soil Parameters

As stipulated in FEMA 310, Section 3.5.2.3.1, for a soil profile classified as Class F, a Class E soil profile may be assumed for a Tier 1 Evaluation. If sufficient data is not available to classify a soil profile a Class E profile shall be assumed. For one- and two-story buildings with a roof height equal to or less than 25-feet, a Class D soil profile may be assumed if site conditions are not known.

A Class D soil profile was assumed based on the FEMA 310 guidelines and confirmed with the aid of a geotechnical investigation report provided by BLM for the warehouse and maintenance building located near the office building site (See Appendix B). The elevations at the base of the braced bay footings are 860.2 and 858.5. The drill hole logs in the geotechnical report indicate that the soil at this elevation has typical blow counts of between 40 and 55. Per FEMA 310, Section 3.5.2.3.1, this defines a Class D type soil.

4.3 Region of Seismicity

Spectral accelerations represent a rare event maximum considered earthquake (MCE) that can be based on either deterministic or probabilistic criteria. Deterministic demands are defined, within a level of confidence, in terms of a specific magnitude event on a particular fault. This approach is considered the most appropriate for buildings located within a few miles of a major active fault. Probabilistic hazards are defined in terms of the probability that more severe demands will be experienced (probability of exceedance) in a 50-year period. FEMA 310 probabilistic results represent a 2% chance of exceedance in 50-years, or in other words a 2,475 year mean return period.

The FEMA 310 spectral acceleration contour Map Packet, Map Nos. 1 and 2 and the National Seismic Hazard Mapping Project website [2] were used to determine the short-period and 1 second spectral response accelerations. The short-period (0.2 second) and 1 second period spectral response accelerations are S_S = 35.6 %g and S_1 = 10.9 %g, respectively. A copy of the spectral response accelerations determined from the website is included in Appendix B.

The maps are based on 5% critical damping for a soil site Class B and must be factored by site coefficients and 2/3 to obtain a design earthquake for the local site conditions. Per FEMA 310, Tables 3-5 and 3-6, site coefficient $F_v = 2.36$ and $F_a = 1.52$. This results in a design short-period spectral response acceleration parameter $S_{DS} = 2/3\ F_a\ S_S = 0.36g$, and a design one second period spectral response acceleration parameter $S_{D1} = 2/3\ F_v\ S_1 = 0.17g$.

Per FEMA 310, Table 2-1, the region of seismicity is designated as moderate for the S_{DS} parameter > 0.167g and < 0.500g and as moderate for the S_{D1} parameter > 0.067g and < 0.200g. This results in a moderate region of seismicity.

4.4 Building Occupancy

The building serves as an office and current occupancy is approximately 125 people. This data was obtained from the RVS form (See Appendix B).

4.5 Historic Significance

Per FEMA 273, Section 1.6.1.3, a building is historic if it is at least 50 years old and is listed in or potentially eligible for the National Register of Historic Places and/or a state or local register as an individual structure or as a contributing structure in a district. The structure was constructed in 1980, which results in a building age of 19 years. The structure is considered not to have any historical significance.

---

[2] The U.S.G.S. Internet site http://geohazards.cr.usgs.gov/eq/html/zipcode.shtml along with the site postal zip code was used to accurately determine the probabilistic parameters.

LIBRARY
JAN 2 0 2000
Bureau of Reclamation
Reclamation Service Center

4.6 Risk Analysis Demand-to-Capacity Ratio

The Risk Analysis Demand-to-Capacity ratio (DCR) is calculated for this building using the draft Methodology "*Risk Analysis: Prioritized Ranking of Bureau Buildings for Seismic Rehabilitation*" found in the December 1998 revision to the Department of the Interior Plan for the Implementation of Executive Order 12941.

A Tier 1 analysis (Report Section 6.4.1.2.1) of axial stress in the columns of the longitudinal braced bays of Building Section 2 resulted in a DCR of 1.5. A Tier2 analysis (Report Section 7.1.4.2.1 and Section 7.1.5) of the axial stress in the columns resulted in a lowered DCR of 0.32. During the Tier 2 evaluation (Report Section 7.1.5), a typical braced connection had a controlling DCR of 0.58.

5.0 Assumptions

The testing of building materials to determine material strengths is recommended for every FEMA 310 seismic evaluation. It is common for Building Owners to decide not to perform the testing because of the significant costs associated with the testing programs. A materials testing program was not used on this facility during the evaluation.

5.1 Tier 1 Material Strengths

Default material properties and strengths for the Tier I evaluation are outlined in FEMA 310, Section 2.2, Commentary. However, material properties are listed on the original design drawings provided (See Appendix A, Figure No. 14, "Structural Notes", "Design Stresses") and these material strengths were used in the Tier 1 evaluation.

5.1.1 Structural Steel Strength

Structural steel plates, angles, and columns - Yield Strength, F_y = 36,000 psi.

Structural steel beams and channels - Yield Strength, F_y = 50,000 psi.

5.1.2 Bolt Strength

Bolts for steel to steel connections - ASTM A-325X.

5.2 Tier 2 Material Strengths

FEMA 310, Section 2.2 does not require material testing and does not allow the use of default values for material properties for a Tier 2 Evaluation. Material property data shall be obtained from building codes from the year of construction of the building being evaluated, from as-built plans, or from physical tests.

Per FEMA 310, Section 4.2.4.4, the expected strength is equal to 1.25 times the nominal strength.

5.2.1 Structural Steel and Bolt Strengths

The nominal strengths of materials used during the Tier 2 evaluation were the same as those used in the Tier 1 evaluation. These values are based on the material strength shown on the original design drawings. Refer to Report Section 5.1 (Tier 1 Material Strengths).

5.2.2 Weld Strength

The strength of weld metal was not shown on the original design drawings. An E60XX (60,000 psi) welding electrode was assumed. Welding rods used at the time of construction could have been E60XX or E70XX (70,000 psi).

6.0 Tier 1 Screening Phase

The building was designed in 1978 and constructed in 1980. Structural notes (See Appendix A, Figure No. 14) indicate that the design was based in accordance with the 1976 Uniform Building Code (UBC), which is prior to any of the benchmark years (1988 UBC) for Steel Braced Frame, Building Type S2 listed in FEMA 310, Section 3.2, Table 3-1.

Foundation and geologic site hazards, nonstructural, and structural evaluation checklists are included in Appendix C. Check list items and/or deficiencies associated with the checklists and Tier 1 evaluation are as follows:

6.1 Geologic Site Hazard and Foundation Checklist

6.1.1 Geologic Site Hazards

6.1.1.1 Liquefaction

Conditions of “Liquefaction” are outlined in FEMA 310, Section 4.7.1.1. Liquefaction susceptible, saturated, loose granular soils that could jeopardize the building’s seismic performance shall not exist in the foundation soils at depths within 50-feet under the building for Life Safety and Immediate Occupancy.

The geotechnical report included in Appendix B does not specifically address the potential for liquefaction; therefore, the potential for the failure mode is not completely certain. The checklist item is therefore considered non-compliant.

6.1.2 Condition of Foundations

6.1.2.1 Foundation Performance

Conditions of "Foundation Performance" are outlined in FEMA 310, Section 4.7.2.1. There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure.

The foundations are hidden beneath floor coverings and are not visible. No apparent foundation damage was noted such as heaved floor slab and there was no visible cracking along the exterior foundation walls. The checklist item was considered compliant.

6.2 Basic Nonstructural Checklist

6.2.1 Ceiling Systems

6.2.1.1 Lay-In Tiles

Conditions of "Lay-In Tiles" are outlined in FEMA 310, Section 4.8.2.2. Lay-in tiles used in ceiling panels located at exitways and corridors shall be secured with clips.

The ceiling tiles above exit corridors and stairways are not secured to the suspended ceiling framework with clips. The structure is non-compliant with respect to the lay-in tile requirements.

6.2.1.2 Support

Conditions of "Support" are outlined in FEMA 310, Section 4.8.2.3. The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions.

Many of the gypsum board partitions do not completely extend to the underside of the deck above. "Demountable" partitions (See Appendix A, Photo Nos. 13 and 14) have been added to the structure and these partitions extend only to the bottom of the suspended ceiling system. The "demountable" partitions are constructed of interlocking tongue and groove gypsum board panels. The tops of the gypsum board partitions that do not extend to the deck and the "demountable" partitions are not laterally supported. The structure is non-compliant with respect to support requirements.

6.2.2 Light Fixtures

6.2.2.1 Independent Support

Conditions of "Independent Support" are outlined in FEMA 310, Section 4.8.3.1. Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures.

The flourescent light fixtures are supported in the suspended ceiling track. There are no additional wire supports on the light fixtures. The item is non-compliant with respect to independent support requirements.

6.2.3 Cladding and Glazing

6.2.3.1 Glazing

Conditions of "Glazing" are outlined in FEMA 310, Section 4.8.4.9. Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface shall be laminated annealed or heat strengthened safety glass that will remain in frames when cracked.

There are windows that exceed 16 square feet in area located adjacent to the exterior walkways at the main entrance and the auxiliary entrance on the west side of the building. At the time of the on-site inspection, the type of glass was not identified and the frame details could not be verified. The building specifications were not available at the time of this report and, therefore, it was not possible to determine the type of glass and frame details which were originally specified. The checklist item was therefore considered non-compliant.

6.2.4 Masonry Veneer

6.2.4.1 Shelf Angles

Conditions of "Shelf Angles" are outlined in FEMA 310, Section 4.8.5.1. Masonry veneer shall be supported by shelf angles or other elements at each floor above the first floor.

The typical architectural building details shown on the design drawing (See Appendix A, Figure Nos. 6, 7, and 8) do not show a shelf angle or support at the second floor level. It was not possible to observe or verify the presence of shelf angles at the second floor level during the field investigation. The checklist item was therefore considered non-compliant.

6.2.4.2 Ties

Conditions of "Ties" are outlined in FEMA 310, Section 4.8.5.2. Masonry veneer shall be connected to the back-up with corrosion-resistant ties. The ties shall have a spacing of equal to or less that 36-inches for Life Safety and 24-inches for Immediate Occupancy with a minimum of one tie for every 2 2/3 square feet.

The typical architectural building details shown on the design drawing (See Appendix A, Figure Nos. 6, 7, and 8) do not show the spacing or the type of ties used to attach the brick veneer. It was not possible to observe the ties during the field investigation due to their location within the walls. The checklist item was therefore considered non-compliant.

6.2.4.3 Weakened Planes

Conditions of "Weakened Planes" are outlined in FEMA 310, Section 4.8.5.3. Masonry veneer shall be anchored to the back-up at weakened planes such as at the locations of flashing.

The typical architectural building details shown on the design drawing (See Appendix A, Figure Nos. 6, 7, and 8) do not clearly show the presence of masonry veneer anchors at weakened planes caused by flashing and other conditions. It was not possible to observe the location of these ties during the field investigation. The checklist item was therefore considered non-compliant.

6.2.5 Building Contents and Furnishings

6.2.5.1 Tall Narrow Contents

Conditions of "Tall Narrow Contents" are outlined in FEMA 310, Section 4.8.11.1. Contents with a height-to-depth ratio greater than 3 for Immediate Occupancy and 4 for Life Safety shall be anchored to the floor slab or adjacent walls.

The building contains tall narrow bookshelf and storage cabinet units which are approximately 17-inches deep and 78-inches high. This produces a height-to-depth ratio of 4.6 which is non-compliant with the acceptance criteria (See Appendix A, Photo Nos. 12 and 13).

6.3 Supplemental Nonstructural Checklist

A supplemental nonstructural checklist was not prepared. This checklist is not required by FEMA 310, Section 3.3, Table 3-2 for a Life Safety performance level in moderate seismic area.

6.4 Basic Structural Checklist

The building is located in a moderate seismic zone and is designated with a Life Safety performance level. FEMA 310, Section 3.3, Table 3-2 requires that a basic structural checklist be prepared. A CBT S2 (Steel Braced Frame with Rigid Diaphragms) basic structural checklist was prepared per the requirements of FEMA 310, Section 3.3.

In order to effectively complete the "Quick Checks" embedded within the structural checklists, weights and seismic force data is required. As documented in Appendix D, Excel Files BOISDOPT.XLS and BOISEDOWT.XLS, the following loads[3] were calculated and used in the evaluation:

Building Section 1:

Roof Diaphragm and Support Beams	130,000 lbs.
Walls & Columns Attributable to Roof Diaphragm[4]	85,000 lbs.
Partitions Attributable to Roof Diaphragm[3, 4]	21,840 lbs.

---

[3] Rounded.

[4] Weight is based on 50% of element weight.

Building Section 2:

Roof Diaphragm and Support Beams	340,000	lbs.
Walls & Columns Attributable to Roof Diaphragm [3]	220,000	lbs.
Partitions Attributable to Roof Diaphragm[3, 4]	60,480	lbs.
Second Floor Diaphragm	680,000	lbs.
Walls & Columns Attributable to Second Floor Diaphragm[3]	282,000	lbs.
Partitions Attributable to Second Floor Diaphragm[3, 5]	120,960	lbs.
Dead weight of building	1,940,280	lbs.
Snow (effective)	0	lbs.
Total Seismic Weight of Building	1,940,280	lbs.

Even though it is not explicitly defined in the Handbook for calculating the pseudo lateral force, as part of normal practice, all of the at-grade weight and half of the first-story wall weight was omitted in the analysis of the seismic diaphragm loads [5]. It is assumed that the seismic shear force from the remaining half of the total wall weight passes directly to the foundation without stressing the wall and column elements and does not transfer this weight into the lateral restraint system.

FEMA 310, Section 3.5.2.1 and Section 4.2.4.2, indicates that if the full design snow load is greater than 30 psf, the effective snow load is equal to either 70 percent of the full design snow load or, where conditions warrant and approved by the regulatory agency, not less than 20 percent of the full design snow load shall be included in the total seismic weight. The minimum design snow load for the City of Boise is 25 pounds per square foot. This value was obtained from the City of Boise Building Department at (208) 384-3802. The original design load for the roof is 30 pounds per square foot. This value is shown on the original design drawing (See Appendix A, Figure No. 14). The higher value of 30 pounds per square foot was considered for this report. It was concluded that the seismic weight did not include any effective snow load.

Per FEMA 310, Section 3.5.2, the results of the Tier 1 pseudo lateral force and parameter calculations are as follows (See Appendix D, MathCad file BOISDOT1.MCD):

	Transverse	Longitudinal
Design short-period SRA *, S_{DS}	0.36g	0.36g
Design 1 second period SRA, S_{D1}	0.17g	0.17g
Period coefficient, C_t	0.030	0.030
Fundamental period of building, seconds	0.352	0.352

---

[5] Based on minimum partition load required by FEMA 310, Section 3.5.2.1.

SRA at fundamental natural period, S_a	0.36g	0.36g
Modification factor, C	1.2	1.2
Pseudo-lateral-force factor (C S_a)	0.432	0.432
Building Sect. 1 total seismic weight, (lbs.)	236,840	236,840
Building Sect. 1 pseudo lateral force, (lbs.) ($V = C S_a W$)	102,203	102,203
Building Sect. 2 total seismic weight, (lbs.)	1,703,440	1,703,440
Building Sect. 2 pseudo lateral force, (lbs.) ($V = C S_a W$)	735,084	735,084

* SRA: Spectral Response Acceleration

6.4.1 Steel Braced Frames

The following items and/or deficiencies were identified for the steel braced frames in the transverse and longitudinal direction using the basic structural checklist for Building Type S2--Steel Braced Frames with Stiff Diaphragms.

6.4.1.1 Building System

6.4.1.1.1 Weak Story

Conditions of "Weak Story" are outlined in FEMA 310, Section 4.3.2.1. The strength of the lateral-force-resisting-system in any story shall not be less than 80% of the strength in an adjacent story, above or below, for Life Safety and immediate Occupancy.

The strength of the second story braces (5-inch-diameter standard pipe) is 77% of the strength of the first story braces (6-inch-diameter standard pipe). The building is non-compliant with this criteria.

6.4.1.2 Lateral Force Resisting System

6.4.1.2.1 Axial Stress Check

Conditions of "Axial Stress Check" are outlined in FEMA 310, Section 4.4.1.3.2. The axial stress due to gravity loads in columns subjected to overturning forces shall be less than $0.1F_y$ for Life Safety and Immediate Occupancy. Alternately, the axial stress due to overturning forces alone, calculated using the Quick Check Procedure of Section 3.5.3.6, shall be less than $0.30F_y$ for Life Safety and Immediate Occupancy.

The columns in the longitudinal and transverse braced frames of both Building Section 1 and Section 2 do not meet the gravity load acceptance criteria. The columns in the longitudinal and transverse braced bays of Building Section 1 and the columns in the transverse braced frames of Building Section 2 do meet the alternative overturning load criteria permitted by FEMA 310, Section 4.4.1.3.2. The columns in the longitudinal braced frames of Building Section 2 do not meet the alternate overturning load criteria. The DCR for the columns in the longitudinal braced frames of Building Section 2 is 1.5 (See Appendix D, MathCad file BOISDOT1.MCD). The building is therefore non-compliant with respect to axial stress check criteria in the columns.

6.4.1.2.2 Redundancy

Conditions of "Redundancy" are outlined in FEMA 310, Section 4.4.3.1.1. The number of lines of braced frames in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. The number of braced bays in each line shall be greater than 2 for Life Safety and 3 for Immediate Occupancy.

The number of braced frames in each principal direction is greater than two. The number of braced bays in each line is typically one. The building is non-compliant with respect to redundancy criteria.

6.5 Supplemental Structural Check List

The building is designated to have a Life Safety performance level and per FEMA 310, Table 2-1, the region of seismicity is moderate. Per FEMA 310, Section 3.3, Table 3-2 a supplemental structural check lists is not required for a structure in a moderate region of seismicity with a Life Safety performance level.

7.0 Deficiency-Only Tier 2 Analysis

Per FEMA 310, Section 4.1, a Full-Building Tier 2 analysis and evaluation of the adequacy of the lateral-force-resisting system shall be performed for all buildings designated as "T2" per FEMA 310, Section 3.4, Table 3-3. A CBT of S2 in a moderate region of seismicity has a "No Limit" designation which indicates that the building does not require a Full-Building Tier 2 analysis.

Per FEMA 310, Section 4.1, the design professional may choose to perform a "Deficiency-Only" Tier 2 analysis that addresses only deficiencies identified in the Tier 1 Screening Phase Evaluation.

A Deficiency-Only Tier 2 evaluation of the braced frames is required due to the deficiencies identified in the Tier 1 Screening Phase Evaluation presented in Report Section 6.4 (Basic Structural Checklist).

7.1 Linear Static Procedure

The Linear Static Procedure (LSP) from FEMA 310, Section 4.2.2.1, was used in the evaluation. The LSP was performed as required by the Procedures of Sections 4.3 through 4.6.

7.1.1 Loading

The pseudo lateral force was calculated for both the transverse and longitudinal directions using FEMA 310, Section 3.5.2.1, Equation 3-1. The story shear forces were calculated using FEMA 310, Section 4.2.2.1.2, Equation 4-2. The Tier 2 pseudo lateral force and parameter calculations are as follows (See Appendix E, MathCad file BOISDOT2.MCD):

	Transverse	Longitudinal
Design short-period SRA *, S_{DS}	0.36g	0.36g
Design 1 second period SRA, S_{D1}	0.17g	0.17g
Period coefficient, C_t	0.030	0.030
Fundamental period of building, seconds	0.352	0.352
SRA at fundamental natural period, S_a	0.36g	0.36g
Modification factor, C	1.2	1.2
Pseudo-lateral-force factor ($C\ S_a$)	0.432	0.432
Section** 1 total seismic weight, (lbs.)	236,840	236,840
Section** 1 pseudo lateral force, (lbs.) ($V = C\ S_a W$)	102,203	102,203
Section** 2 roof seismic weight, (lbs.)	620,480	620,480
Section** 2 floor seismic weight, (lbs.)	1,082,960	1,082,960
Section** 2 total seismic weight, (lbs.)	1,703,440	1,703,440
Section** 2 pseudo lateral force, (lbs.) ($V = C\ S_a W$)	735,084	735,084

* SRA: Spectral Response Acceleration

** Building Section

7.1.2 Modeling

Planar frame mathematical models were developed in accordance with

FEMA 310, Section 4.2.3 (See Appendix E, STAAD Files BOISDOL2.ANL, BOISDOT2.ANL, and BOISDOL1.ANL). Typical transverse and longitudinal braced frames were used for the analysis. The structure is considered as having a rigid diaphragm at the second floor level. FEMA 310, Section 4.2.3.1 and Section 4.2.3.2 requires that torsional effects be taken into account when modeling a structure with rigid diaphragms. The amount of eccentricity caused by the difference between the center of mass of the structure and the center of gravity of the lateral-force-resisting system is minimal. The eccentricity is approximately 2% to 4%. A torsional analysis was not made based on the small eccentricities involved. In lieu of the torsional analysis, the seismic forces were conservatively increased by 20% to account for this minor eccentricity for transverse frames in Building Section 2.

The structure is considered as having a flexible diaphragm at the roof level. The flexible diaphragm at the roof level does not induce additional horizontal forces to the lateral-force-resisting system due to torsional effects. Actual and accidental torsional effects were, therefore, not considered for this part of the evaluation. The diaphragm is considered flexible which allows the seismic mass to be assigned on the basis of tributary area, per FEMA 310, Section 4.2.3.4. Vertical acceleration was not considered, per FEMA 310, Section 4.2.3.6.

7.1.3 Acceptance Criteria

Component gravity loads were calculated for both the transverse and longitudinal braced frames in accordance with FEMA 310, Section 4.2.4.2, using load case combination Equations 4-6 and 4-7. The horizontal diaphragm dead loads and actual partition loads were used for calculating the tributary frame dead load. The gravity wall dead load was not used in the frame modeling being that the vertical loads are transferred directly to the foundations (See Appendix A, Figure No. 14). The actual floor live load for Building Section 2 was not calculated, but field observations and engineering judgment deemed that the effective floor live load would be sufficient.

Component actions were calculated in accordance with FEMA 310, Section 4.2.4.3, which included gravity loads as well as lateral seismic forces.

Component strength was calculated in accordance with FEMA 310, Section 4.2.4.4.

Per FEMA 310, Section 4.2.4.3, component actions were classified as either deformation controlled or force controlled. Element flexural moments and axial loads in braces are typically a deformation controlled action while shear forces and column axial loads are typically force controlled actions. Calculations for reaction strengths of connections and joints are governed by deformation controlled actions. The final acceptance criteria was based on the requirements of FEMA 310, Section 4.2.4.5.

7.1.4 Steel Braced Frames

7.1.4.1 Building System

7.1.4.1.1 Weak Story

Conditions of "Weak Story" are outlined in FEMA 310, Section 4.3.2.1. The strength of the lateral-force-resisting-system in any story shall not be less than 80% of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy.

The strength of Building Section 2 second floor braces (5-inch-diameter standard pipe) is 77% of the strength of the first floor braces (6-inch-diameter standard pipe) based on the Tier 1 screening phase evaluation criteria.

Tier 2 evaluation is to perform an analysis in accordance with the procedures in Section 4.2. The story strength shall be calculated, and the adequacy of the lateral-force-resisting elements in the non-compliant story shall be checked for the capacity to resist one half of the total pseudo lateral force.

The vertical distribution of seismic forces performed during the Tier 2 evaluation determined that the vertical distribution factor for the upper story is 0.525 (See Appendix E, Mathcad file BOISDOT2.MCD). This value exceeds the minimum requirement of 0.50. The evaluation performed under Report Section 7.1.4.2.1 (Axial Stress Check) and Section 7.1.4.2.2 (Redundancy) show that the structure story strength is compliant using the higher vertical distribution factor of 0.525. The structure is compliant with the Tier 2 evaluation phase weak story criteria.

7.1.4.2 Lateral-Force-Resisting System

7.1.4.2.1 Axial Stress Check

Conditions of "Axial Stress Check" are outlined in FEMA 310, Section 4.4.1.3.2. The axial stress due to gravity loads in columns subjected to overturning forces shall be less than $0.1F_y$ for Life Safety and Immediate Occupancy. Alternately, the axial stress due to overturning forces alone, calculated using the Quick Check Procedure of Section 3.5.3.6, shall be less than $0.30F_y$ for Life Safety and Immediate Occupancy.

The columns in the longitudinal braced bays of Building Section 2 did not meet the gravity load or the overturning load criteria under the Tier 1 screening phase evaluation.

Tier 2 evaluation is to perform an analysis in accordance with the procedures in Section 4.2. The gravity and overturning demands for non-compliant columns shall be calculated and the adequacy of the columns to resist overturning forces shall be evaluated using the m-factors in Table 4-3.

Columns in both the longitudinal and transverse braced frames of Building Section 1 and Section 2 were analyzed during the Tier 2 evaluation phase. The DCR of all columns were less than one. The columns are compliant with Tier 2 evaluation phase axial stress criteria.

7.1.4.2.2 Redundancy

Conditions of "Redundancy" are outlined in FEMA 310, Section 4.4.3.1.1. The number of lines of braced frames in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. The number of braced bays in each line shall be greater than 2 for Life Safety and 3 for Immediate Occupancy.

The number of braced frames in each principal direction is greater than two. The number of braced bays in each line is typically one or none. The building is non-compliant with respect to redundancy under the Tier 1 screening phase evaluation criteria.

Tier 2 evaluation is to perform an analysis in accordance with the procedures in Section 4.2. The adequacy of all elements and connections in the braced frames shall be evaluated. Existing braces in both the longitudinal and transverse braced frames of Building Section 1 and Section 2 were evaluated during the Tier 2 analysis. The DCR of all braces were less than one. The structure is compliant based on Tier 2 evaluation phase redundancy criteria.

7.1.5 Demand-to-Capacity Ratios

The DCR for the various elements as determined by the Tier 2 evaluation analysis are as follows:

ELEMENT	LOAD	CONTROLLING ACTION	DCR
First Story Longitudinal Brace (Section* 2)	Axial	Deformation	0.32
Second Story Longitudinal Brace (Section* 2)	Axial	Deformation	0.26
First Story Longitudinal Column (Section* 2)	Axial	Force	0.32
Typical Brace Connection	Axial	Force	0.58
First Story Transverse Brace (Section* 2)	Axial	Deformation	0.41
Second Story Transverse Brace (Section* 2)	Axial	Deformation	0.29
First Story Transverse Column (Section* 2)	Axial	Force	0.32
Longitudinal Brace (Section* 1)	Axial	Deformation	0.16
Longitudinal Column (Section* 1)	Axial	Force	0.06

*Building Section

8.0 Tier 3 Detailed Evaluation Phase

A Tier 3 evaluation shall be performed either for the entire building after the requirements of FEMA 310, Chapter 2, have been met or for those elements identified to be deficient in a Tier 1 or Tier 2 Evaluation. There were no contractual requirements to conduct a Tier 3 Evaluation and, therefore, none was performed.

9.0 Deficiencies And Mitigation Recommendation

The rehabilitation recommendations presented in this section of the report are not the only feasible options and should not eliminate other viable options from consideration. The recommendations will deal only with major cost issues needed for the building to exhibit an acceptable, pre-established performance level. It will not address the more complete and detailed analyses and designs required in a rehabilitation design document, such as the FEMA 273 [2] Guidelines.

9.1 Foundation And Geologic Site Hazard

During the Tier 1 screening phase evaluation, the following foundation and geological items and/or deficiencies were identified (See Report Section 6.1):

- Per conditions of “Liquefaction” as outlined in FEMA 310, Section 4.7.1.1, and Report Section 6.1.1.1, liquefaction could not properly be investigated within the scope of this report because the geotechnical report provide did not address this condition. Recommend that BLM further investigate the checklist item of liquefaction. A geotechnical engineer should be consulted regarding this checklist condition.

9.2 Non-Structural

During the Tier 1 screening phase evaluation, the following deficiencies were identified (See Report Sections 6.2).

- Per conditions of "Lay-In Tiles" as outlined in FEMA 310, Section 4.8.2.2. There are lay-in ceiling tiles used in ceiling panels located at exitways and corridors that are not secured with clips. These ceiling tiles can fall from the tracks and obstruct the exitways and corridors. Recommend that the ceiling tiles be properly attached to the ceiling track system.

- Per conditions of "Support" as outlined in FEMA 310, Section 4.8.2.3. There are gypsum board partitions and "demountable" partitions that do not completely extend to the underside of the deck above. The tops of these partitions are not laterally braced. Recommend that these partitions be laterally anchored to the bottom surface of the floor deck or roof deck above.

- Per conditions of "Independent Support" as outlined in FEMA 310, Section 4.8.3.1. Flourescent light fixtures are supported in the suspended ceiling track with no additional wire supports on the light fixtures. Recommend that the light fixtures be properly anchored.

- Per conditions of "Glazing" as outlined in FEMA 310, Section 4.8.4.9. The type of glass was not identified and the frame details could not be verified. Recommend that these items be verified and that seismic hazard mitigation be performed as required.

- Per conditions of "Shelf Angles" as outlined in FEMA 310, Section 4.8.5.1.

The presence of masonry veneer shelf angles at the second floor level was not verified. Recommend that BLM verify the presence or absence of shelf angles and that seismic hazard mitigation be performed as required. This may require the removal of some mortar from between the bricks.

- Per conditions of "Ties" as outlined in FEMA 310, Section 4.8.5.2. The spacing and type of masonry ties was not verified. Recommend that BLM investigate the type and location of masonry ties and that seismic hazard mitigation be performed as required. This may require the removal of some mortar from between the bricks and/or removal of several bricks.
- Per conditions of "Weakened Planes" as outlined in FEMA 310, Section 4.8.5.3. The presence of masonry veneer anchors at potential weakened planes was not verified. Recommend that BLM investigate the structure for this item. This may require the removal of some mortar from between the bricks and/or removal of several bricks.
- Per conditions of "Tall Narrow Contents" as outlined in FEMA 310, Section 4.8.11.1. There are bookshelf and storage cabinet units that do not meet the height-to-depth ratio acceptance criteria. These items can tip over if they are not anchored to resist overturning forces. Recommend that these items be properly attached to the structure.

9.3 Structural

The Tier 2 Deficiency-Only Evaluation (See Report Section 7.0) determined that the deficiencies determined during the Tier 1 basic structural screening phase evaluation (See Report Sections 6.4) were compliant. There are no structural deficiencies that require remediation.

10.0 Cost of Mitigation

Cost estimate work sheets are included in Appendix H (See Lotus file BOISDOE.WK4). Cost are reported by compliance categories, and are as follows:

10.1 Structural

There were no structural deficiencies identified in Report Sections 6.4, 6.5 and 7.0. A cost estimate for structural deficiencies was not prepared.

10.2 Foundation and Geologic

Foundation and Geologic deficiencies are identified in Report Section 6.1 and summarized in Report Section 9.1.

The cost of performing further investigations pertaining to liquefaction of the foundation have not been included in the attached cost estimate.

10.3 Non-Structural

Non-structural deficiencies are identified in Report Sections 6.2, 6.3 and summarized in Report Section 9.2.

The nonstructural deficiencies identified were not quantified and, therefore, a $3.30/square foot estimate was prepared in accordance with ICSSC TR-17 handbook [6]. This results in a non-structural upgrade cost of $ 120,000 .

10.4 Finishing

There is no structural mitigation required and therefore, no additional finishing costs are considered. A cost estimate for finishing is not included.

11.0 References

[1] “Handbook for the Seismic Evaluation of Buildings -- A Prestandard," American Society of Civil Engineers, FEMA 310, January 1998.

[2] “NEHRP Guidelines for the Seismic Rehabilitation of Buildings," Applied Technology Council, FEMA 273, October 1997.

[3] “Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook," Applied Technology Council, FEMA 154, July 1988.

[4] "Design of Low-Rise Concrete Buildings for Earthquake Forces", Second Edition, David A Fanella and Javeed A Munshi, Published by Portland Cement Association, 1998.

[5] Lindeburg, Michael R., P.E., "Seismic Design of Building Structures, A Professional’s Introduction to Earthquake Forces and Design Details," Professional Publications, Inc., page 55 and 73, Seventh Edition, 1996.

[6] “How-To Suggestions for Implementing Executive Order 12941 on Seismic Safety of Existing Federal Buildings, A Handbook,” National Institute of Standards and Technology, ICSSC TR-17, November 1995.

Appendix A -- Photos and Figures

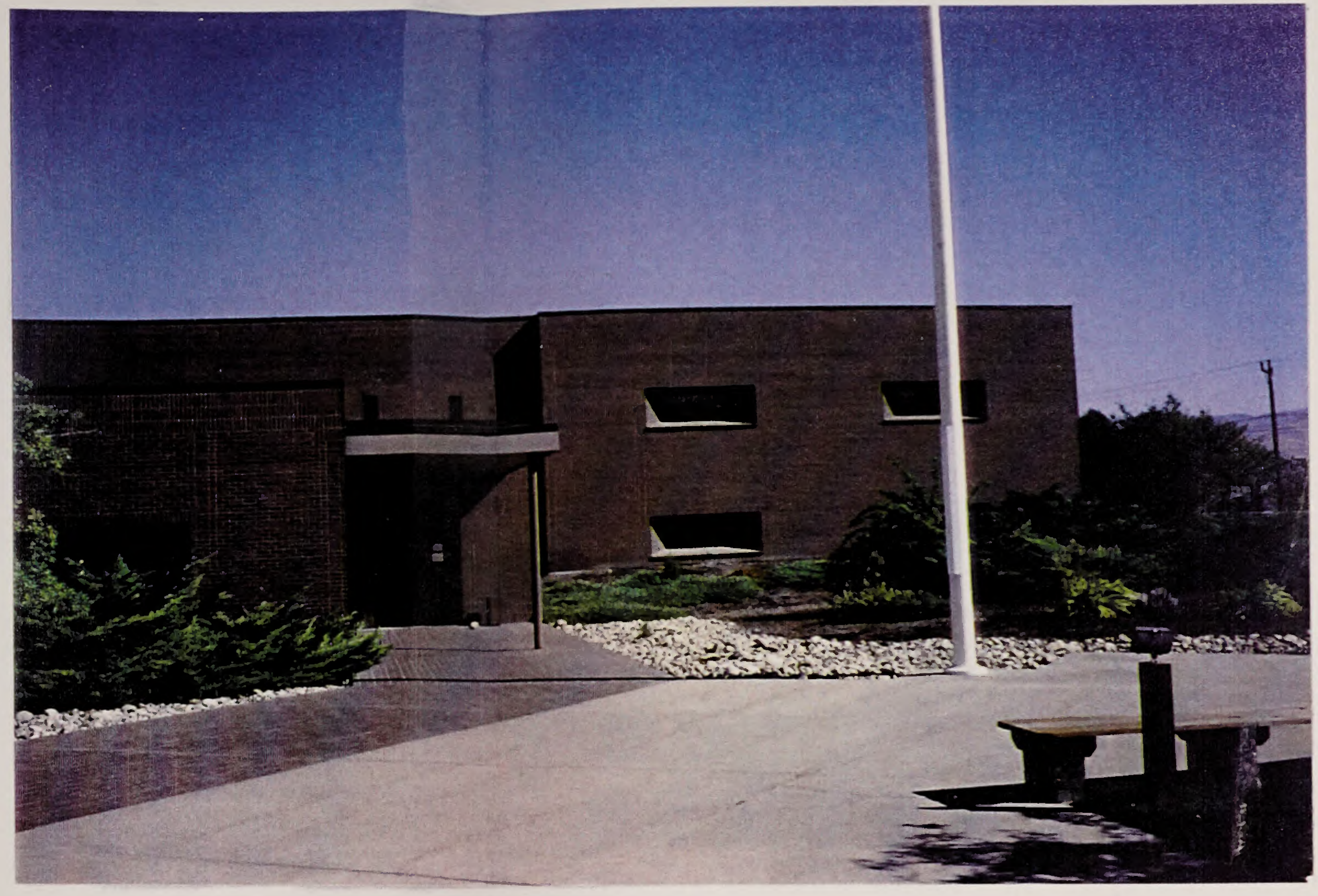


Photo No. 1 - South elevation showing the main entrance to the building.

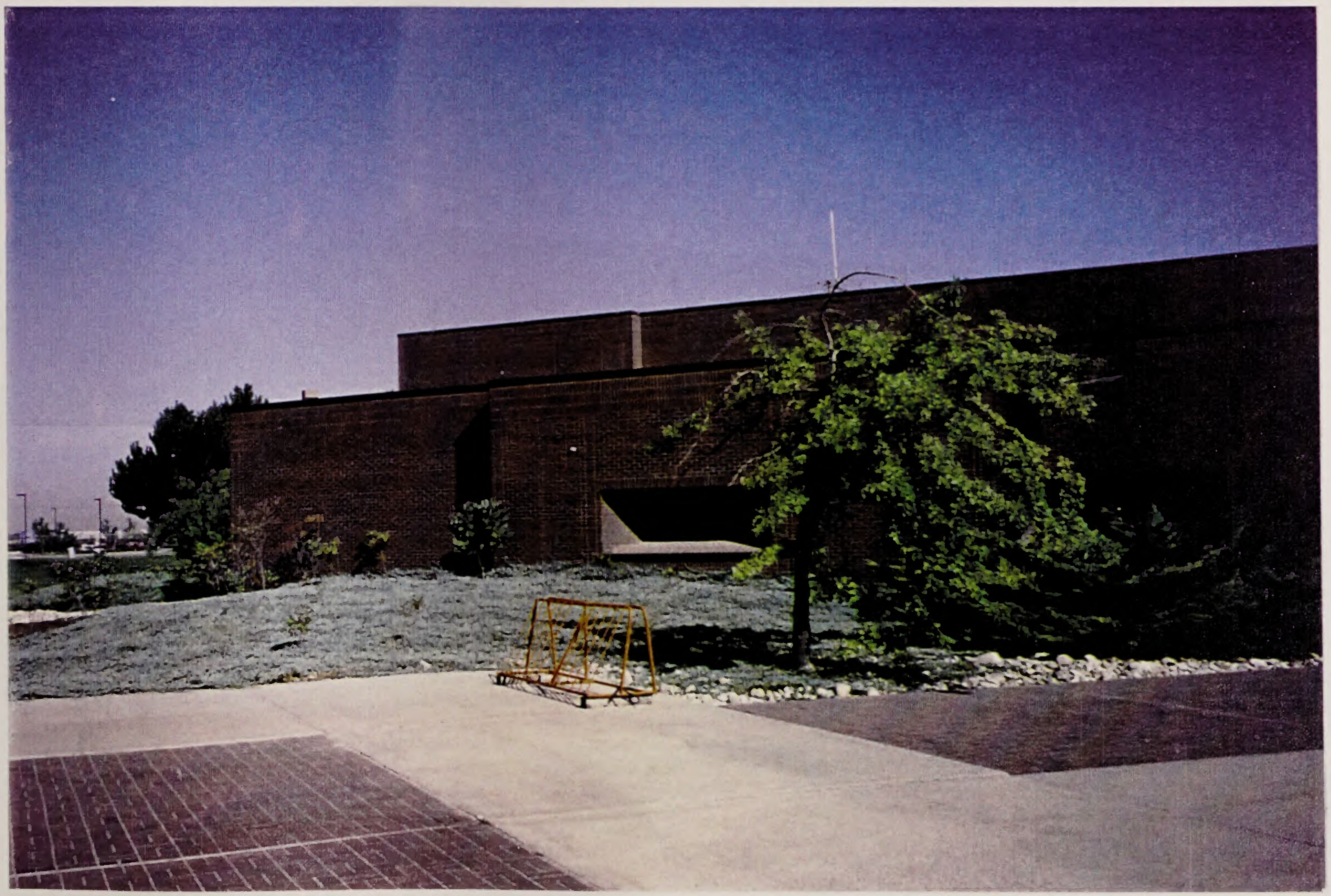


Photo No. 2 - View of the west end of the south elevation.

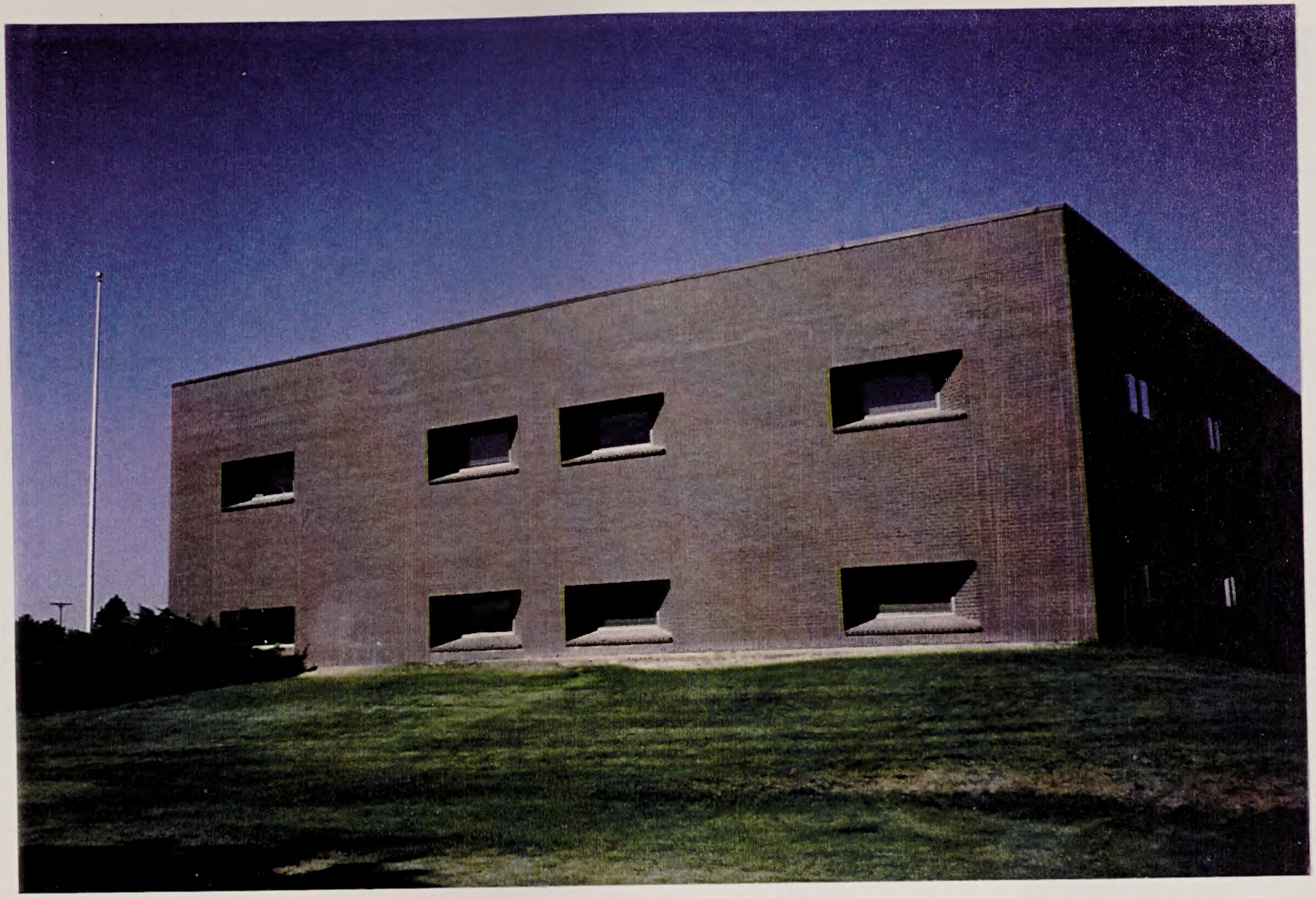


Photo No. 3 - East elevation of building.

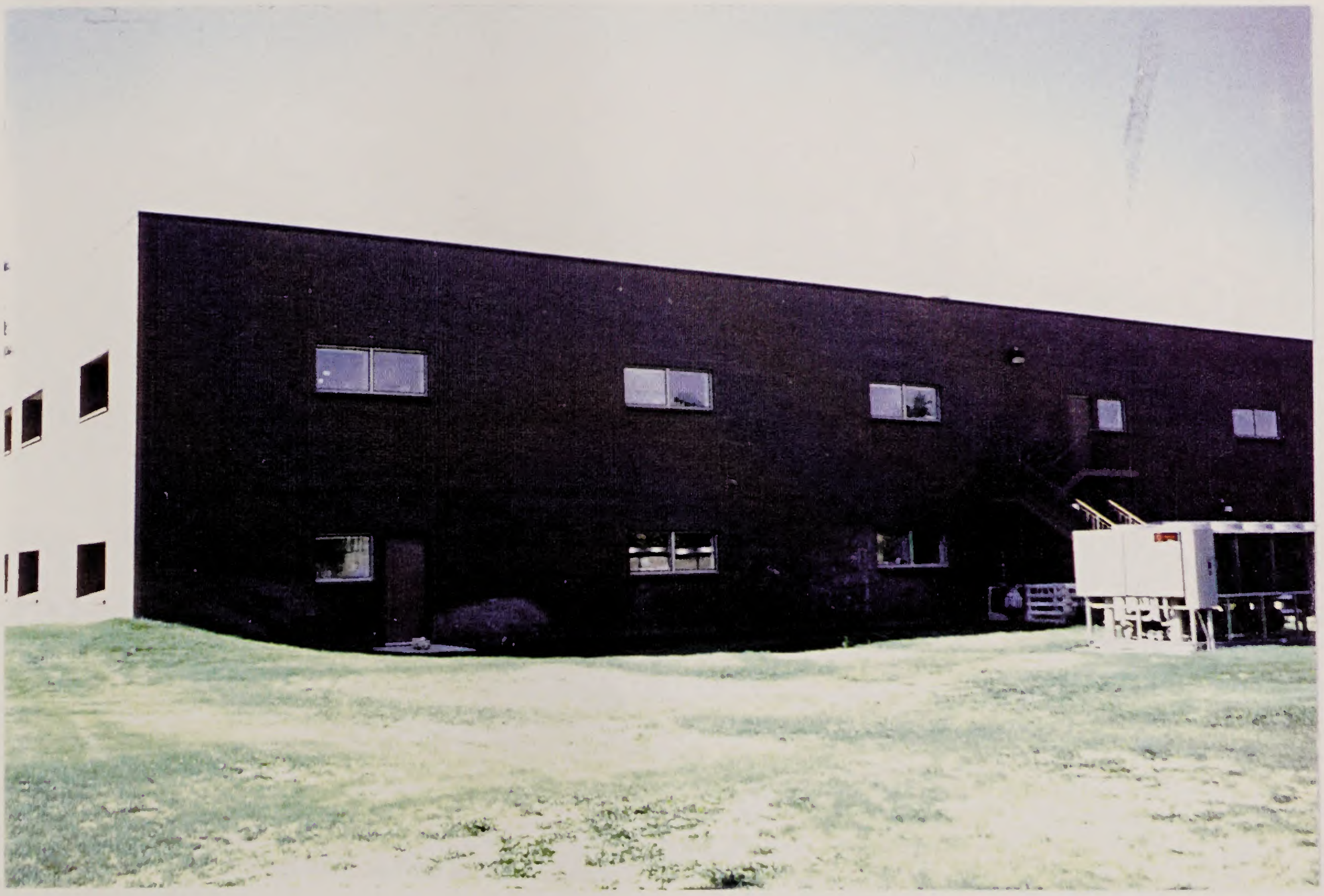


Photo No. 4 - North elevation of building.

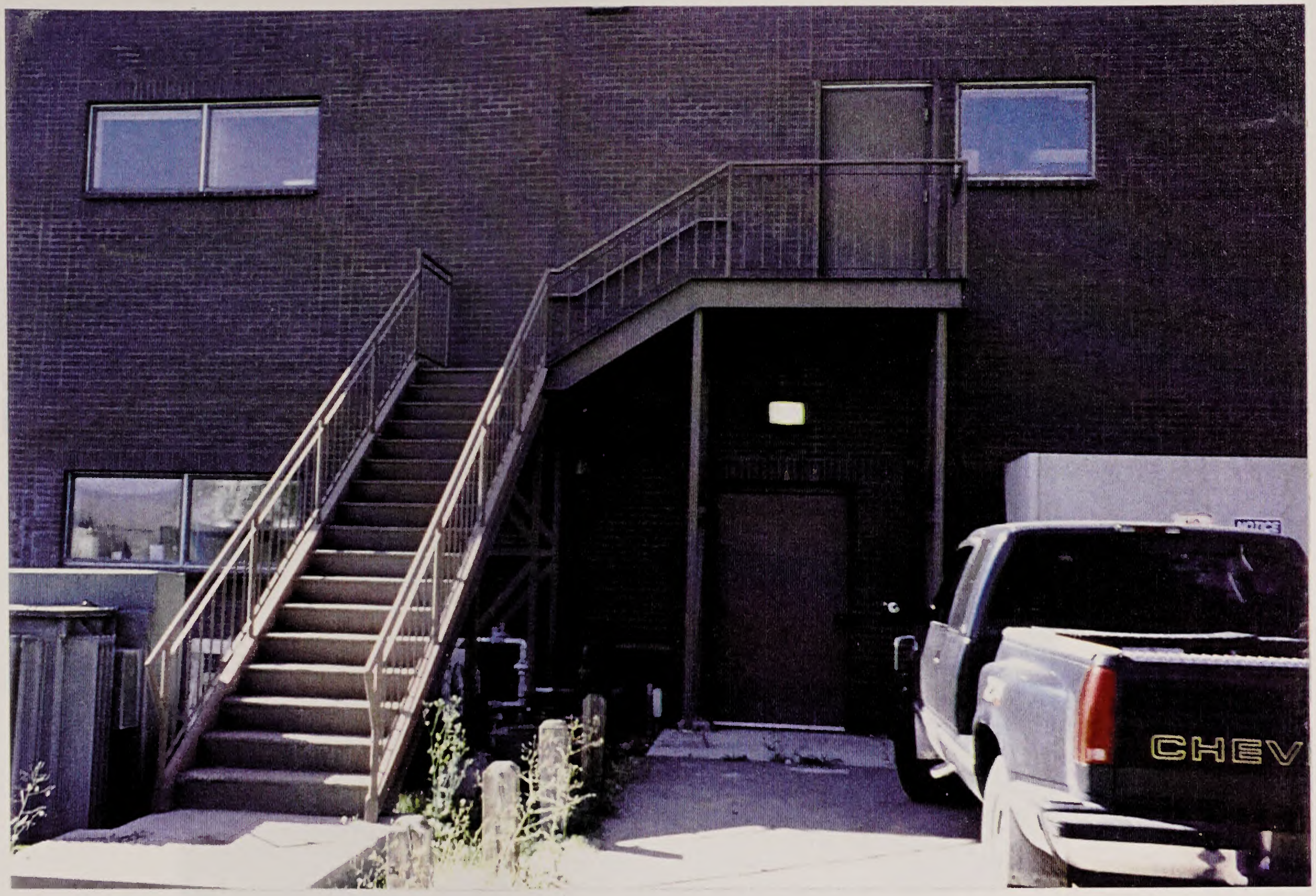


Photo No. 5 - Exit on north side of building.

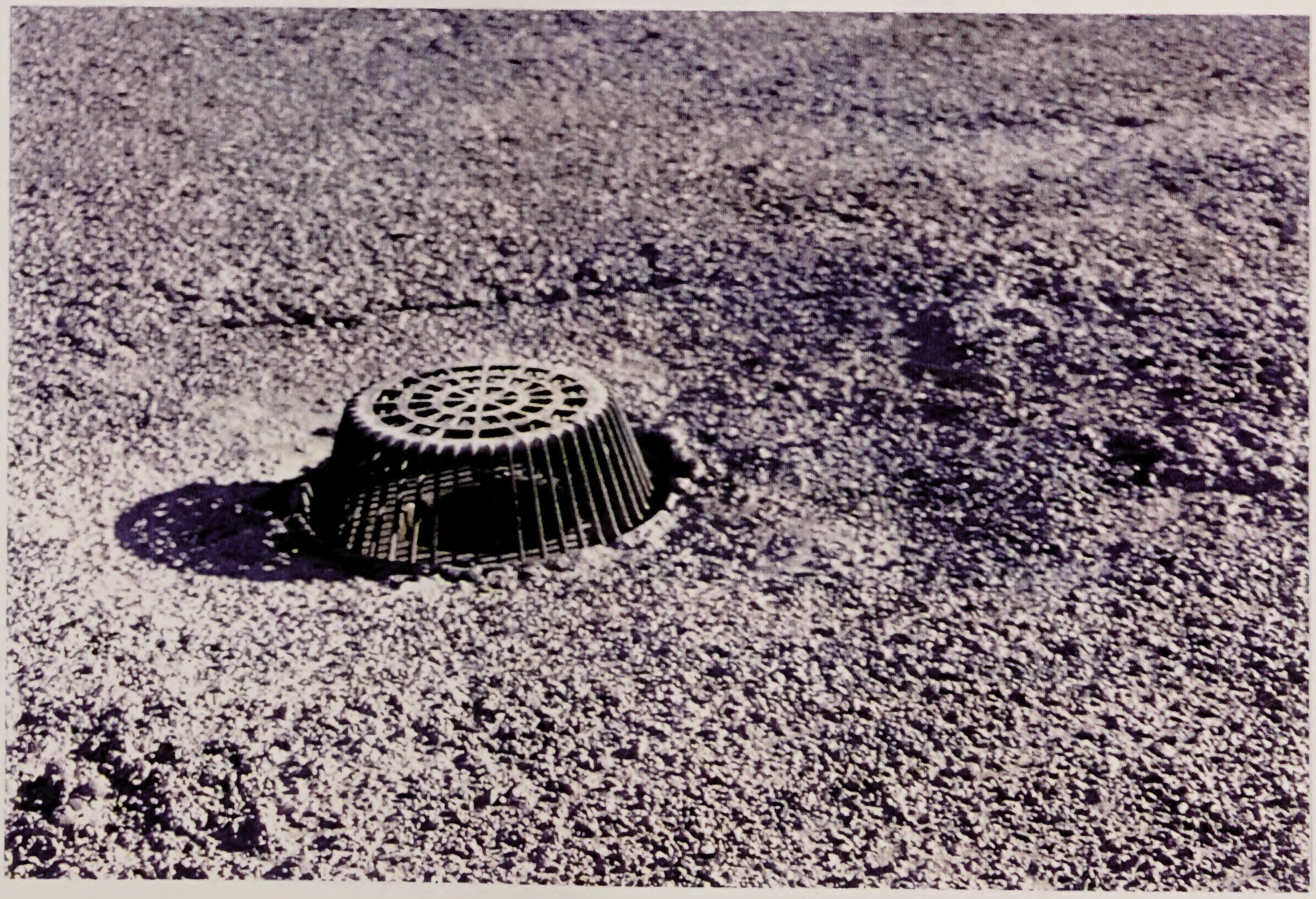


Photo No. 6 - Roof drain and built-up roof with gravel surfacing.

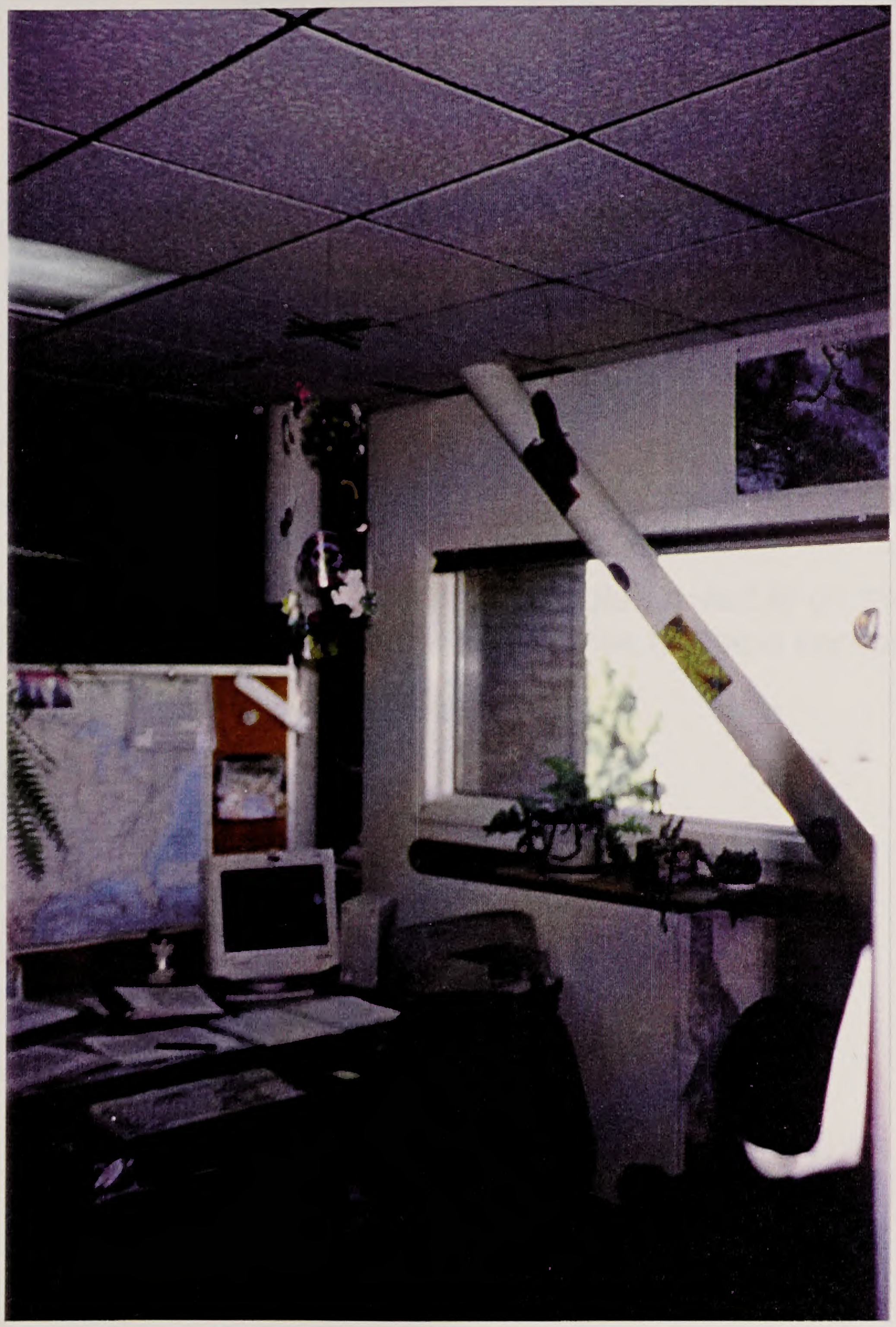


Photo No. 7 - Typical view of steel bracing visible on the interior of building.

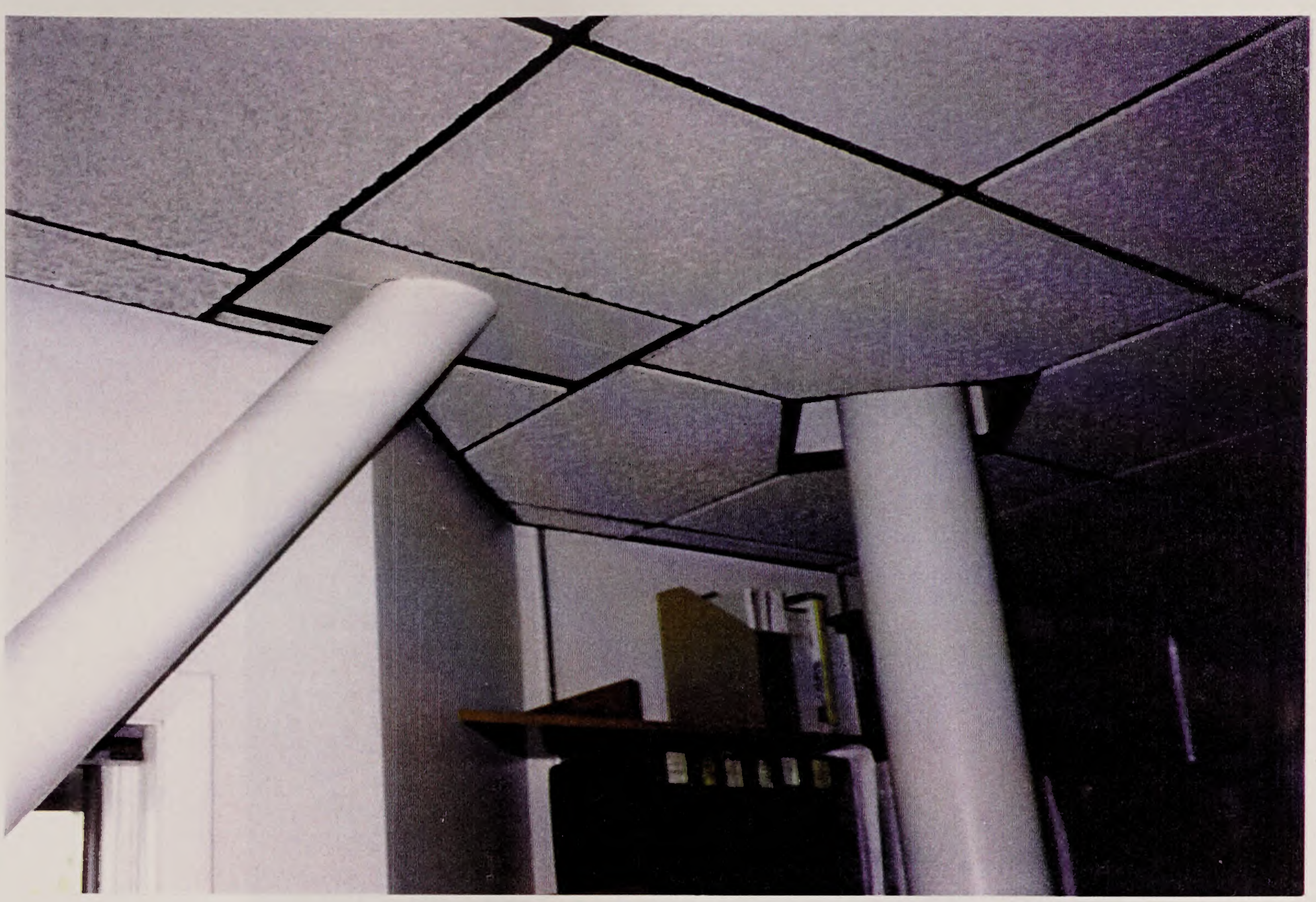


Photo No. 8 - Another view of bracing and column visible on the interior of the building. The columns and braces are pipe sections.

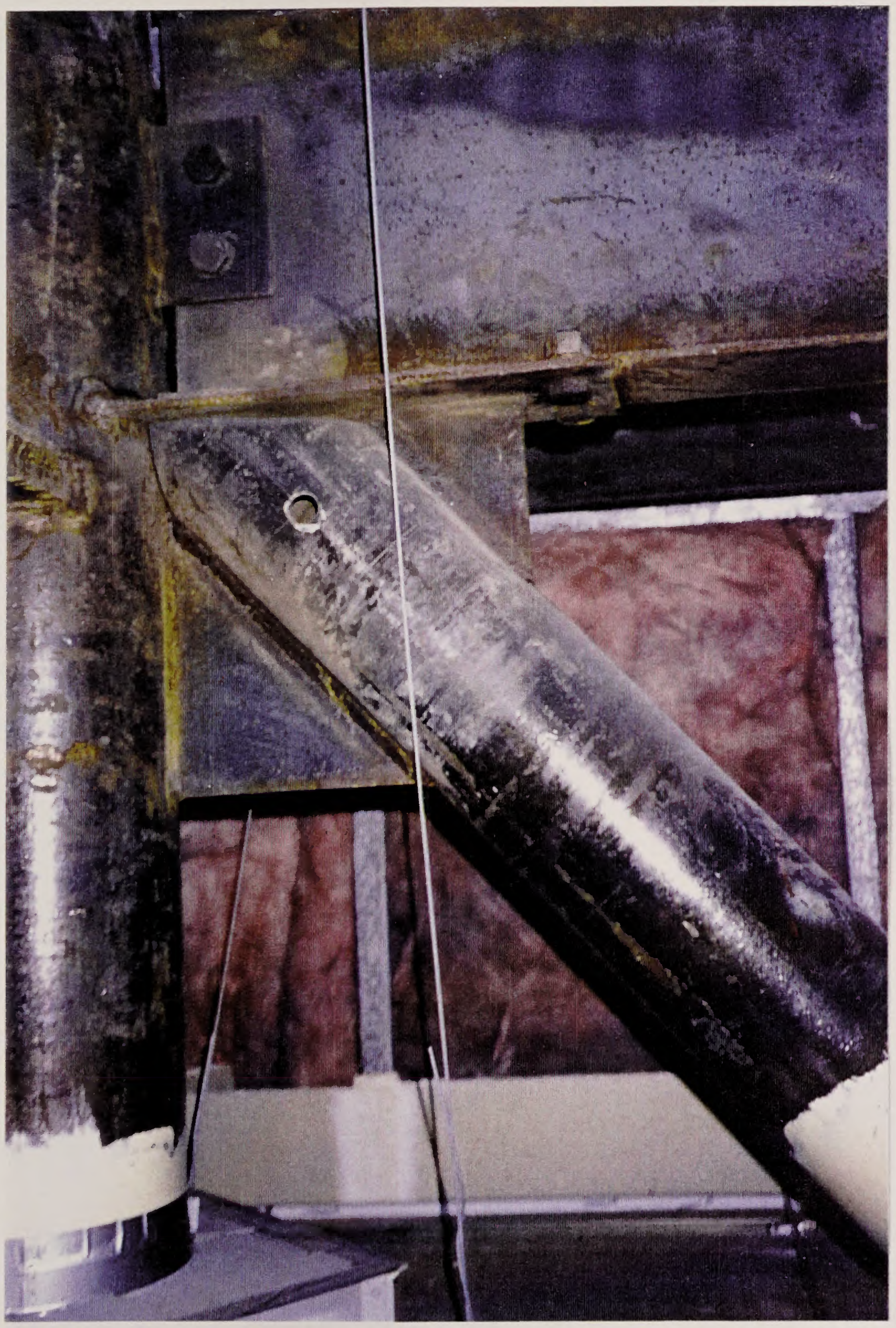


Photo No. 9 - Typical connection of beam, diagonal brace, and column visible above the suspended ceiling system.

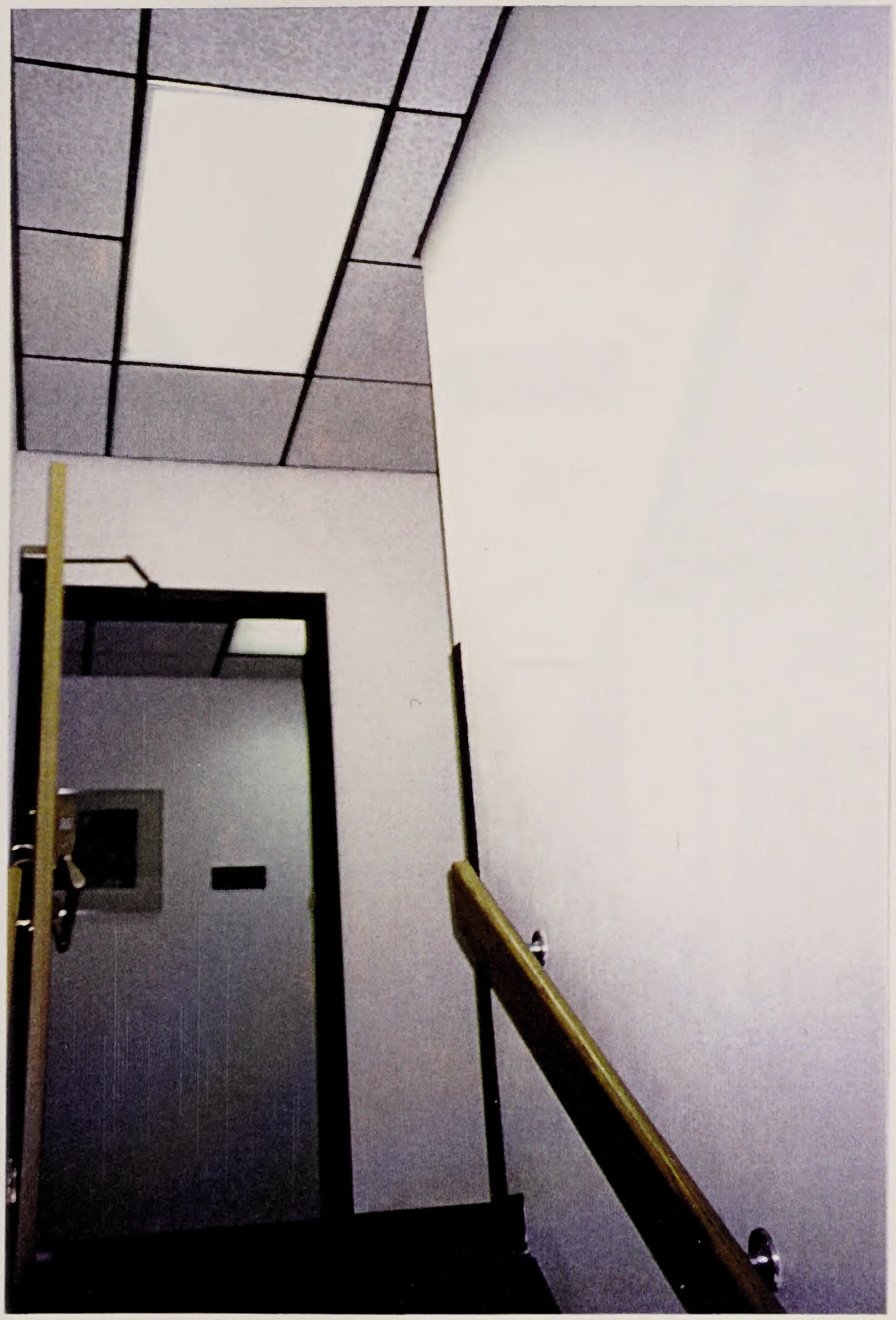


Photo No. 10 - View showing suspended ceiling tile system and flourescent light over stairway.

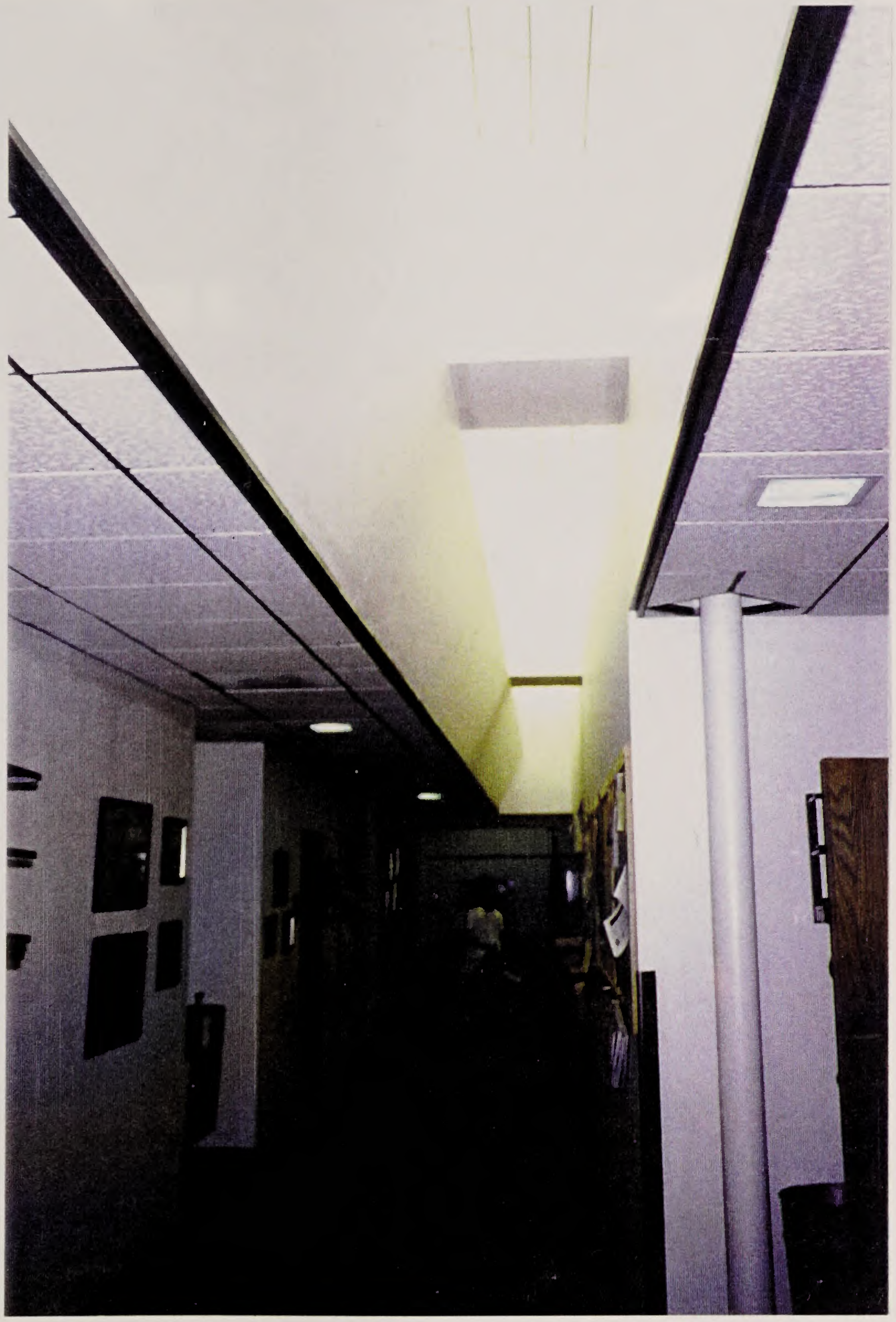


Photo No. 11 - View of suspended ceiling tile system and skylight over corridor in the single story level of the building.

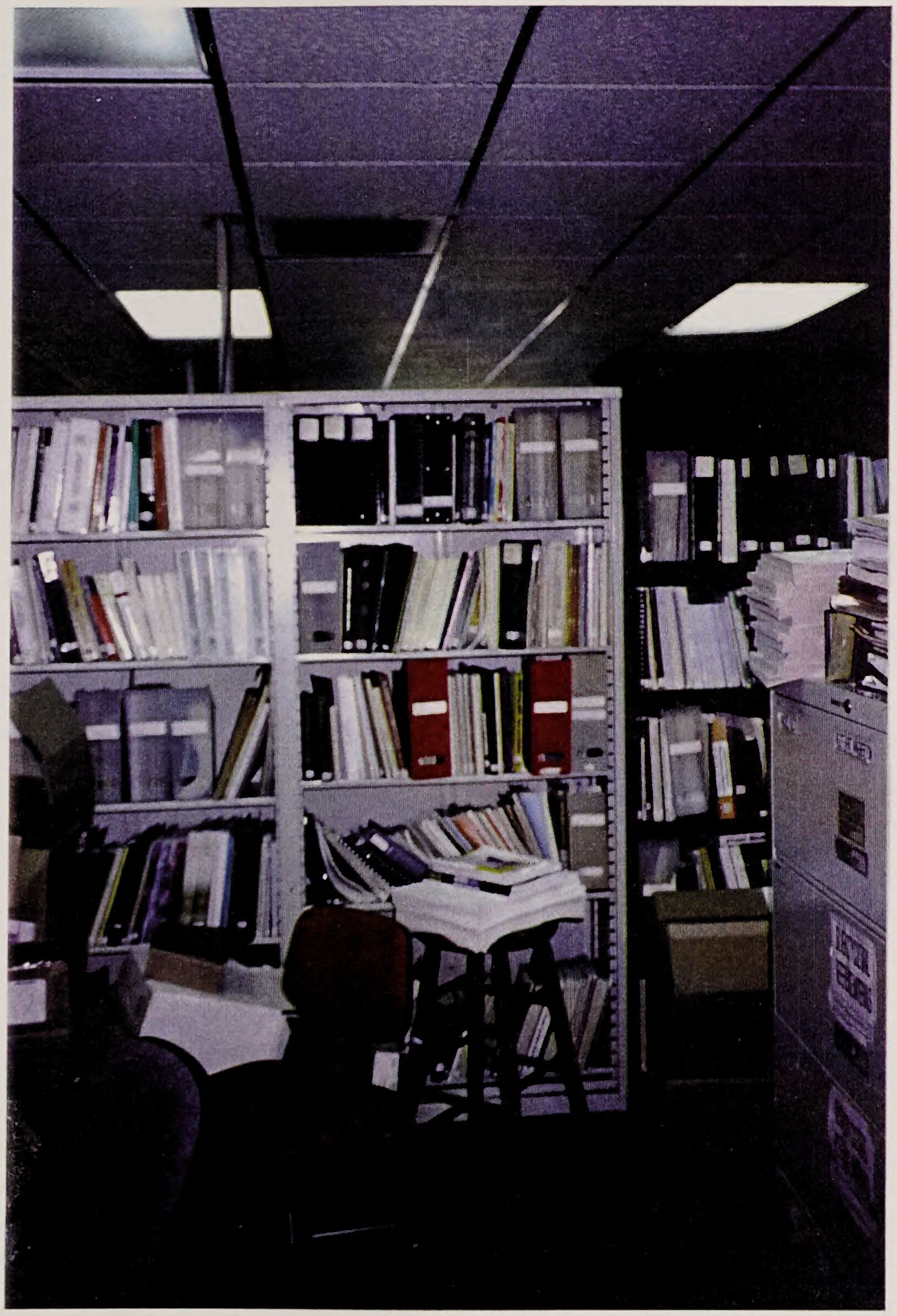


Photo No. 12 - Typical tall slender bookshelf unit.

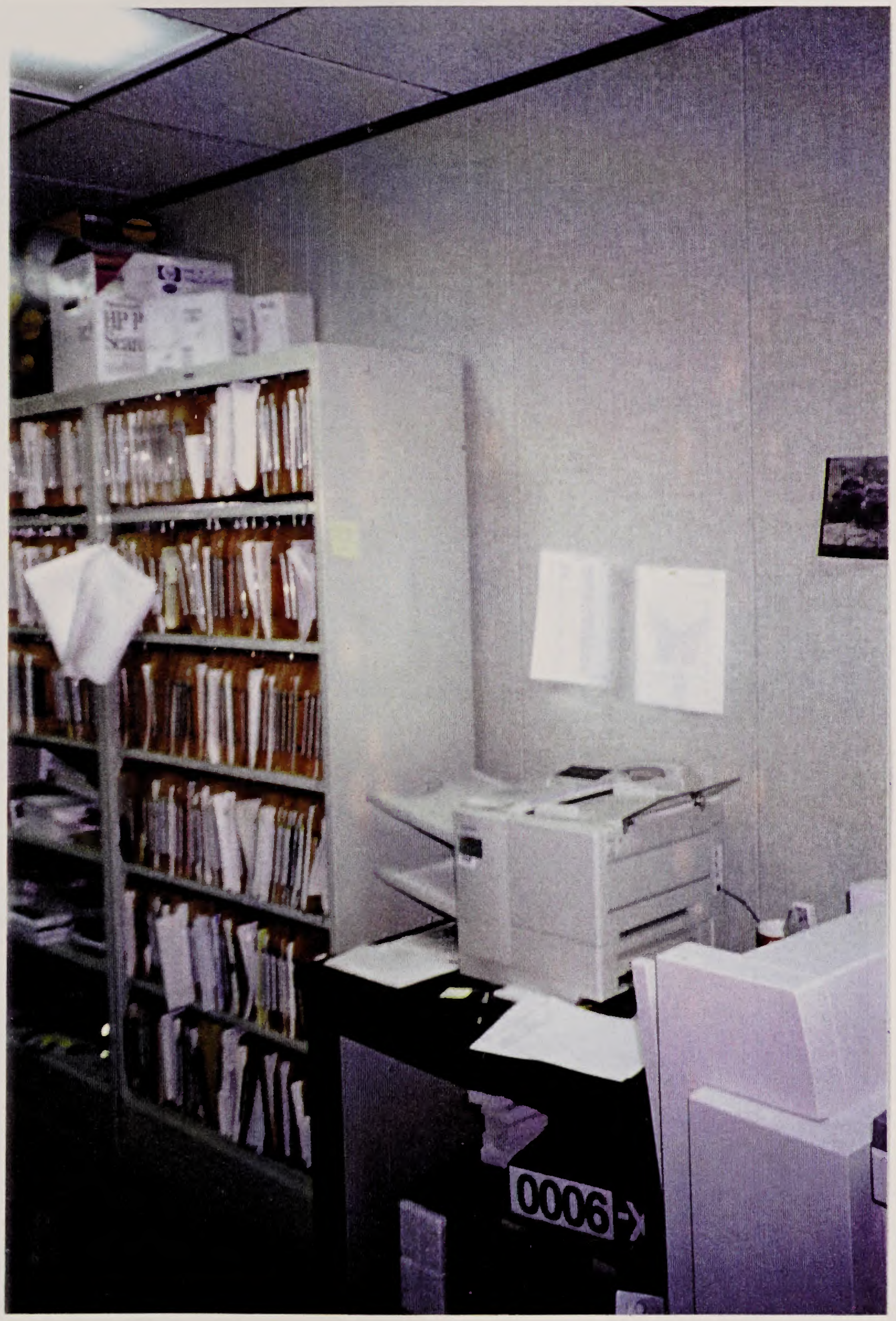


Photo No. 13 - Another view of bookshelf unit and "demountable" partitions.

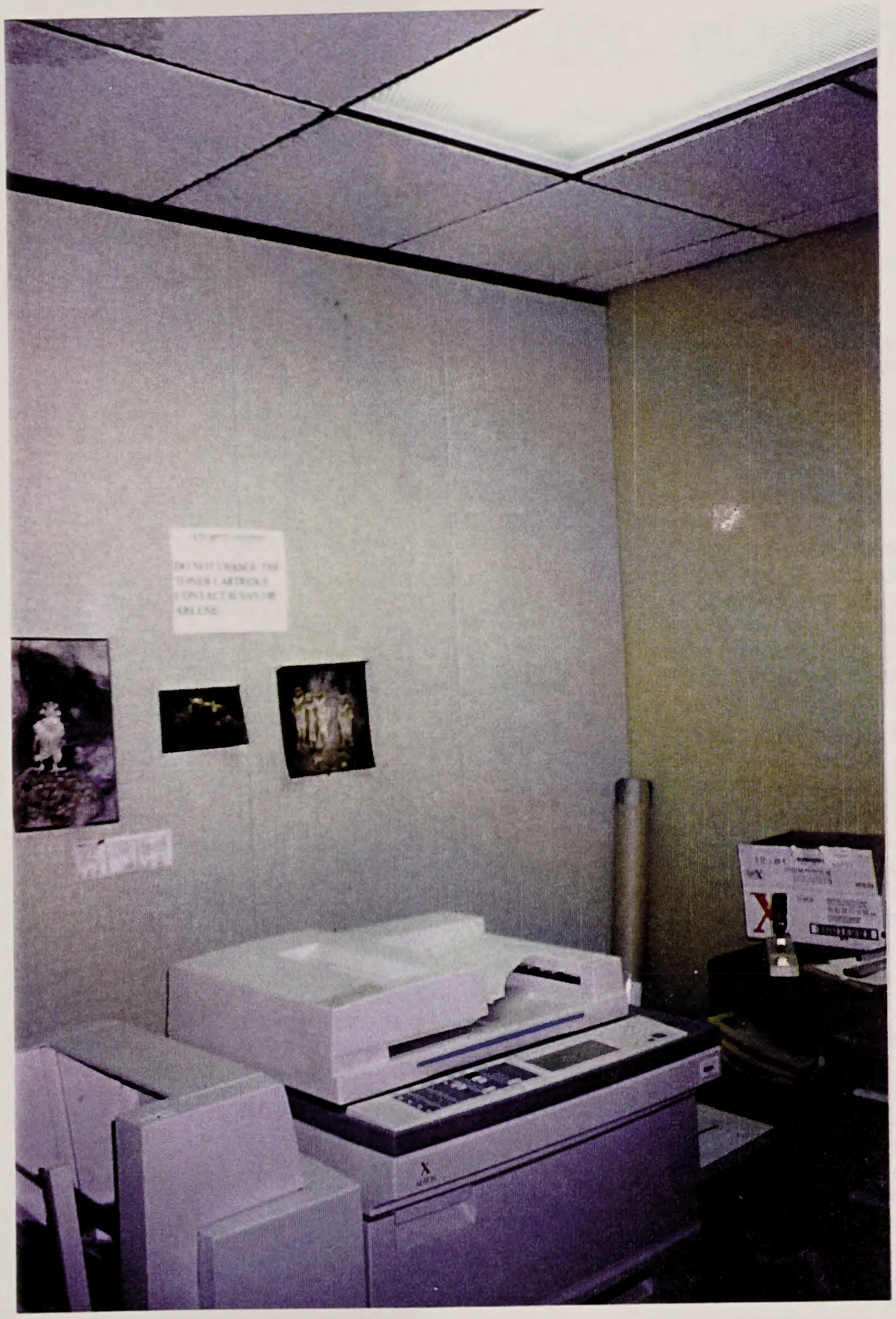
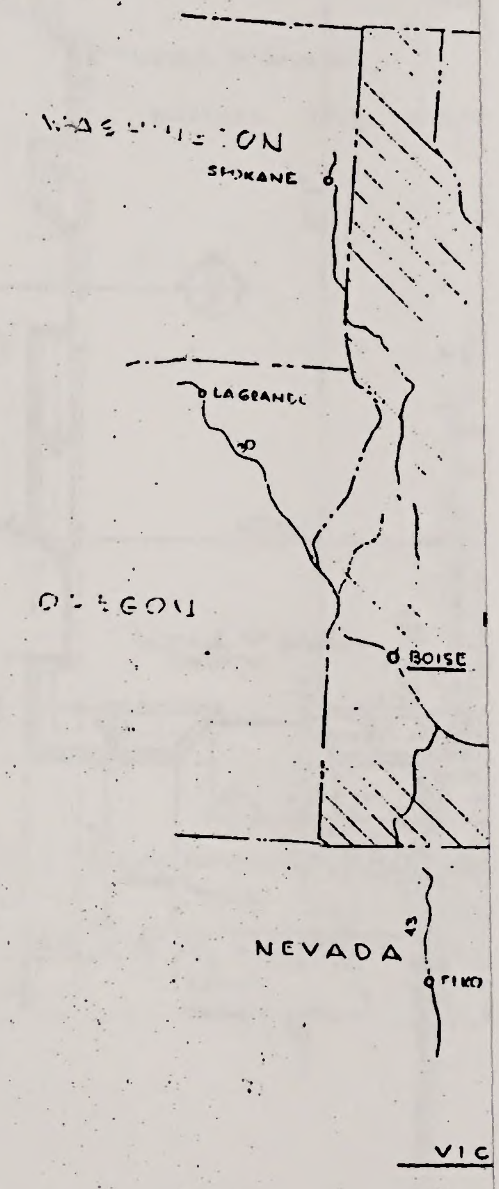


Photo No. 14 - View of "demountable" partition with channel cap at the suspended ceiling level and a standard gypsum board partition extending above the suspended ceiling.

BOISE

U.S



PHASE ONE

DSC PROJECT NO. 1039

DENVER SERVICE CENTER DIVISION OF ENGINEERING

INDEX

SHT. NO.	TITLE
	TITLE SHEET
C1	GRADING & STAKING PLAN
C2	STAKING & PLANTING OF OFFICE AREA
C3	UTILITY PLAN
C4	MISC. SITE WORK DETAILS
C5	SITE DETAILS
C6	SITE DETAILS
C7	LAWN, TREE PLANTING, FIRE OPS. PLANTING
C8	IRRIGATION PLAN
A1	FIRST FLOOR PLAN & DETAILS
A2	ROOM FINISH & DOOR SCHEDULES
A3	SECOND FLOOR PLAN & DETAILS
A4	BUILDING ELEVATIONS & DETAILS
A5	BUILDING SECTIONS
A6	WALL SECTIONS & DETAILS
A7	WINDOW & DOOR DETAILS
A8	MISCELLANEOUS EXTERIOR DETAILS
A9	STAIR SECTIONS & DETAILS
A10	ELEVATOR, RESTROOM, LABORATORY DETAILS
A11	FIRST FLOOR REFLECTED CEILING PLAN
A12	SECOND FLOOR REFLECTED CEILING PLAN
A13	MILLWORK ELEVATIONS & DETAILS
S1	FOUNDATIONS & 1st FLOOR PLAN
S2	2nd FLOOR & LOW ROOF FRAMING PLAN
S3	HIGH ROOF FRAMING PLAN & DETAILS
S4	FOUNDATION DETAILS
S5	CONCRETE DETAILS
S6	STRUCTURAL STEEL DETAILS
S7	FRAMING PLAN & STEEL DETAILS
S8	TRUSS ELEVATIONS & DETAILS
S9	TRUSS & MISCELLANEOUS DETAILS
S10	TRUSS, STAIR, & MISCELLANEOUS DETAILS
S11	COLUMN SCHEDULE & MISCELLANEOUS DETAILS
M1	WATER SUPPLY DIAGRAM - 1st FLOOR
M2	WATER SUPPLY DIAGRAM - 2nd FLOOR
M3	DRAIN, WASTE & VENT DIAGRAM - 1st FLOOR
M4	DRAIN, WASTE & VENT DIAGRAM - 2nd FLOOR
M5	HEAT, VENTING & AIR CONDITIONING - 1st FLOOR
M6	HEAT, VENTING & AIR CONDITIONING - 2nd FLOOR
M7	HVAC, NORTH MECHANICAL EQUIPMENT ROOM
M8	HVAC, SOUTH MECHANICAL EQUIPMENT ROOM
M9	H.W. HEAT, CHW & NATURAL GAS PIPING
M10	CONTROL SEQUENCE & EQUIPMENT SCHEDULE
E1	ELECTRICAL LEGEND, RISER DIAGRAMS & NOTES
E2	SITE PLAN & DETAILS, MECHANICAL ROOM POWER
E3	ELECTRICAL FIXTURE & PANEL SCHEDULES
E4	ELECTRICAL - 1st FLOOR LIGHTING PLAN
E5	ELECTRICAL - 2nd FLOOR LIGHTING PLAN
E6	ELECTRICAL - 1st FLOOR POWER & TELEPHONE PLAN
E7	ELECTRICAL - 2nd FLOOR POWER & TELEPHONE PLAN

FIGURE NO. 1

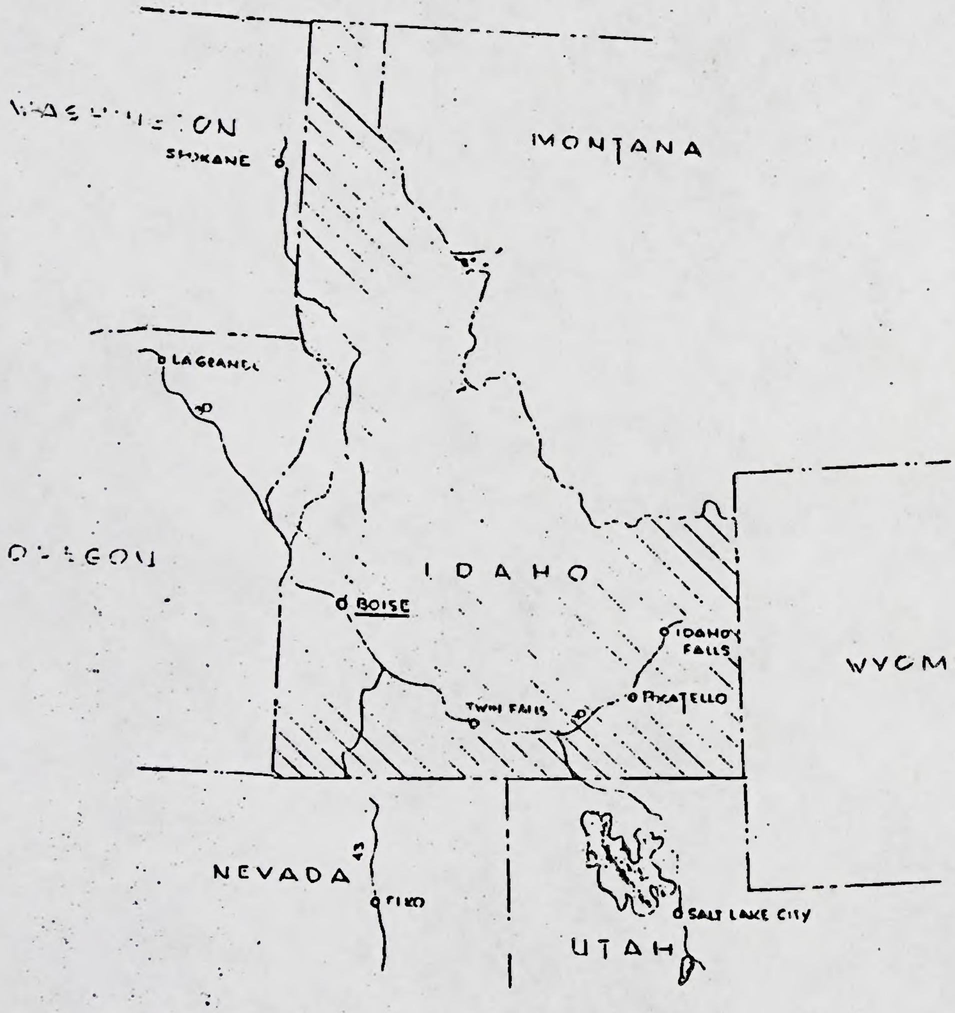
BOISE DISTRICT OFFICE COMPLEX

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

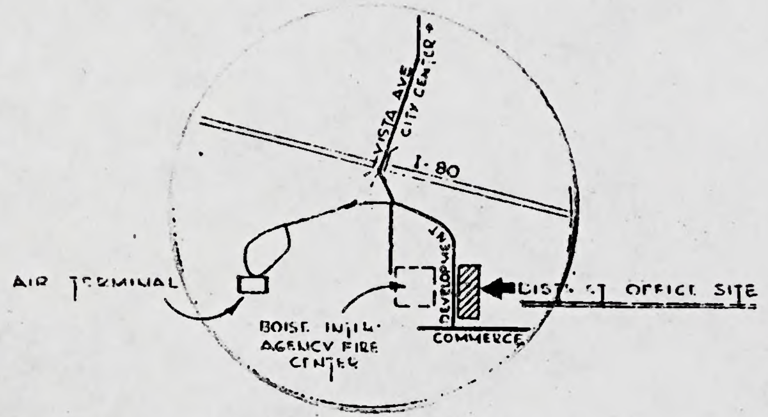
PHASE ONE

DSC PROJECT NO. 1039

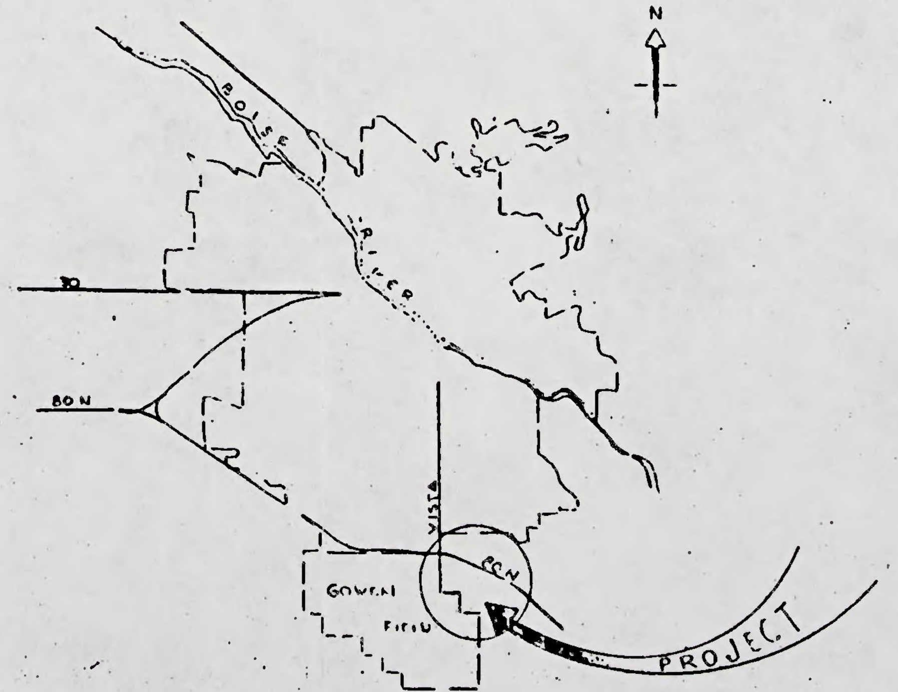
DENVER SERVICE CENTER   DIVISION OF ENGINEERING



VICINITY MAP



PROJECT LOCATION



CITY OF BOISE

INDEX

SHT. NO.	TITLE
	TITLE SHEET
C1	GRADING & STAKING PLAN
C2	STAKING & PLANTING OF OFFICE AREA
C3	UTILITY PLAN
C4	MISC. SITE WORK DETAILS
C5	SITE DETAILS
C6	SITE DETAILS
C7	LAWN, TREE PLANTING, FIRE OPS. PLANTING
C8	IRRIGATION PLAN
A1	FIRST FLOOR PLAN & DETAILS
A2	ROOM FINISH & DOOR SCHEDULES
A3	SECOND FLOOR PLAN & DETAILS
A4	BUILDING ELEVATIONS & DETAILS
A5	BUILDING SECTIONS
A6	WALL SECTIONS & DETAILS
A7	WINDOW & DOOR DETAILS
A8	MISCELLANEOUS EXTERIOR DETAILS
A9	STAIR SECTIONS & DETAILS
A10	ELEVATOR, RESTROOM, LABORATORY DETAILS
A11	FIRST FLOOR REFLECTED CEILING PLAN
A12	SECOND FLOOR REFLECTED CEILING PLAN
A13	MILLWORK ELEVATIONS & DETAILS
S1	FOUNDATIONS & 1st FLOOR PLAN
S2	2nd FLOOR & LOW ROOF FRAMING PLAN
S3	HIGH ROOF FRAMING PLAN & DETAILS
S4	FOUNDATION DETAILS
S5	CONCRETE DETAILS
S6	STRUCTURAL STEEL DETAILS
S7	FRAMING PLAN & STEEL DETAILS
S8	TRUSS ELEVATIONS & DETAILS
S9	TRUSS & MISCELLANEOUS DETAILS
S10	TRUSS, STAIR, & MISCELLANEOUS DETAILS
S11	COLUMN SCHEDULE & MISCELLANEOUS DETAILS
M1	WATER SUPPLY DIAGRAM - 1st FLOOR
M2	WATER SUPPLY DIAGRAM - 2nd FLOOR
M3	DRAIN, WASTE & VENT DIAGRAM - 1st FLOOR
M4	DRAIN, WASTE & VENT DIAGRAM - 2nd FLOOR
M5	HEAT, VENTING & AIR CONDITIONING - 1st FLOOR
M6	HEAT, VENTING & AIR CONDITIONING - 2nd FLOOR
M7	HVAC, NORTH MECHANICAL EQUIPMENT ROOM
M8	HVAC, SOUTH MECHANICAL EQUIPMENT ROOM
M9	H.W. HEAT, CHW & NATURAL GAS PIPING
M10	CONTROL SEQUENCE & EQUIPMENT SCHEDULE
E1	ELECTRICAL LEGEND, RISER DIAGRAMS & NOTES
E2	SITE PLAN & DETAILS, MECHANICAL ROOM POWER
E3	ELECTRICAL FIXTURE & PANEL SCHEDULES
E4	ELECTRICAL - 1st FLOOR LIGHTING PLAN
E5	ELECTRICAL - 2nd FLOOR LIGHTING PLAN
E6	ELECTRICAL - 1st FLOOR POWER & TELEPHONE PLAN
E7	ELECTRICAL - 2nd FLOOR POWER & TELEPHONE PLAN

FIGURE NO. 1

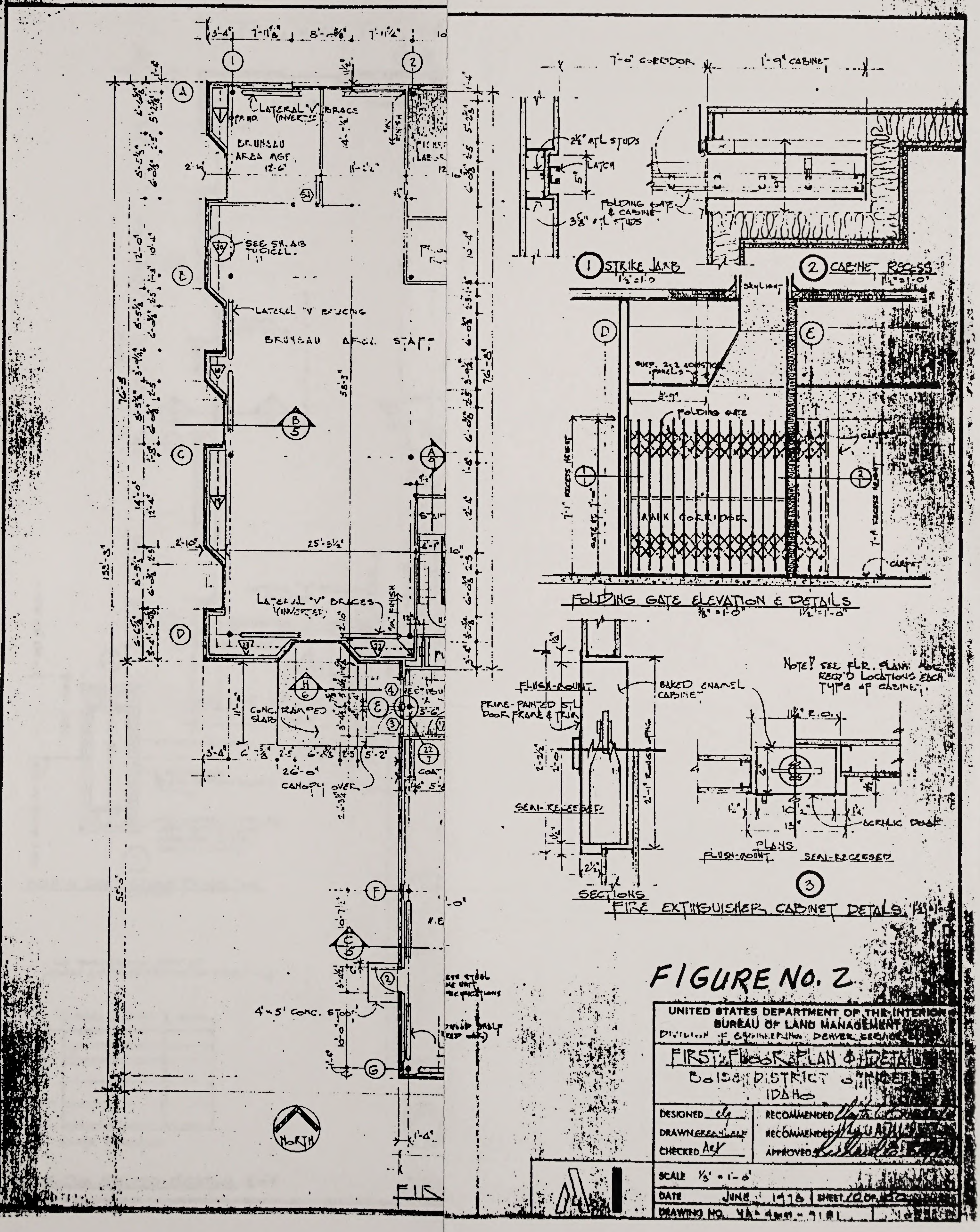


FIGURE NO. 2

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER
FIRST FLOOR PLAN & DETAILS
BOISE DISTRICT OFFICE
IDAHO
DESIGNED
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED
SCALE 1/8" = 1'-0"
DATE JUNE 1978
SHEET
DRAWING NO.
1 STRIKE JAMB 1½" = 1'-0"
2 CABINET RECESS 1½" = 1'-0"
FOLDING GATE ELEVATION & DETAILS
3 FIRE EXTINGUISHER CABINET DETAILS
SECTIONS
PLANS
FLUSH-MOUNT
SEMI-RECESSED
BAKED ENAMEL CABINET
PRIME-PAINTED STL DOOR FRAME & TRIM
ACRYLIC DOOR
NOTE: SEE FLR. PLAN FOR REQ'D LOCATIONS EACH TYPE OF CABINET.
7'-0" CORRIDOR
1'-9" CABINET
2½" MTL STUDS
LATCH
FOLDING GATE & CABINET
3⅝" MTL STUDS
SKYLIGHT
FOLDING GATE
MAIN CORRIDOR
CARPET
LATERAL "V" BRACE (INVERTED)
BRUNEAU AREA MGR.
BRUNEAU AREA STAFF
LATERAL "V" BRACING
LATERAL "V" BRACES (INVERTED)
CONC. RAMPED SLAB
CANOPY OVER
4' x 5' CONC. STOOP
NORTH
135'-3"
76'-8"
55'-5"
25'-3½"
58'-3"
26'-0"

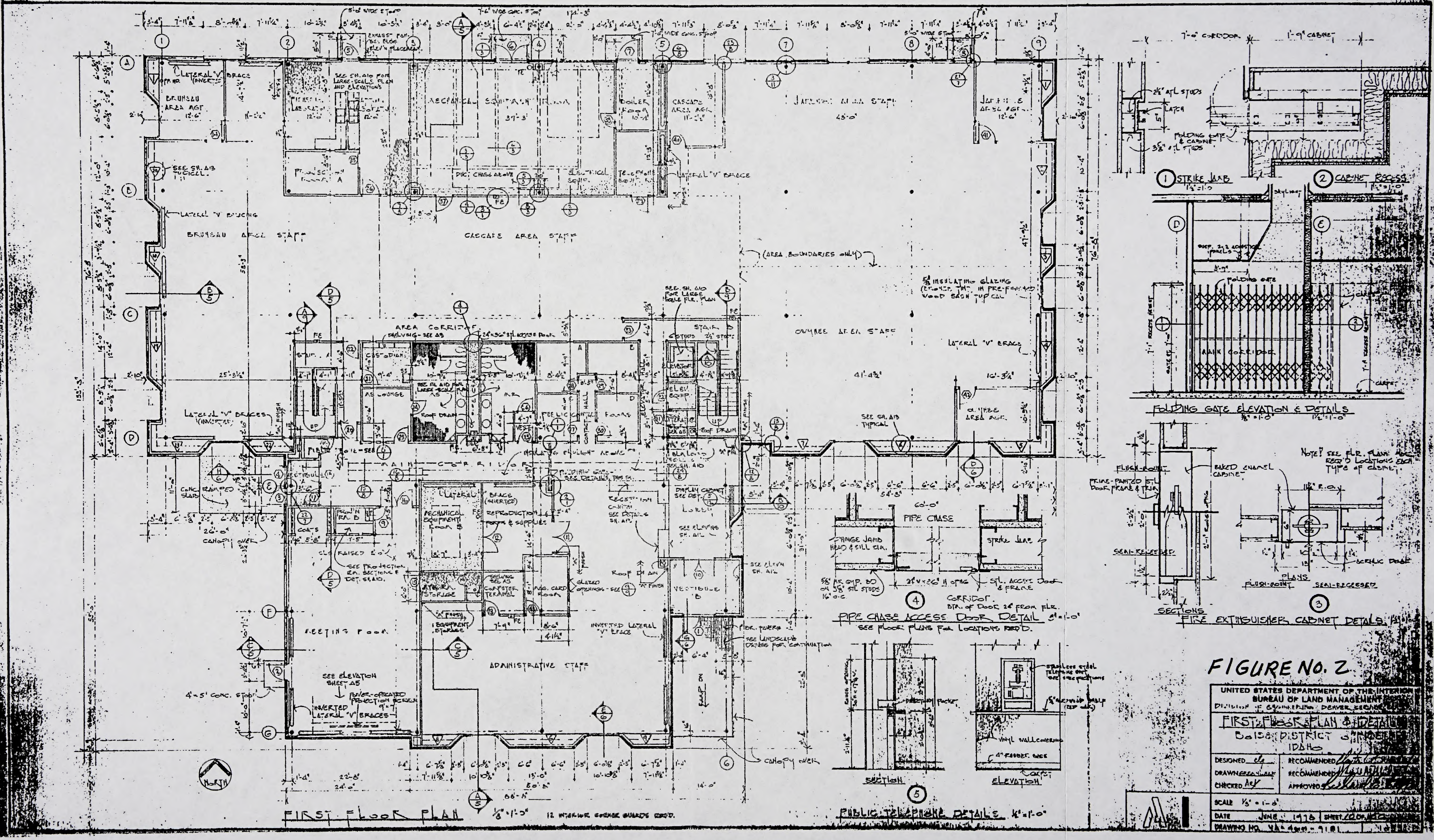


FIGURE NO. 2

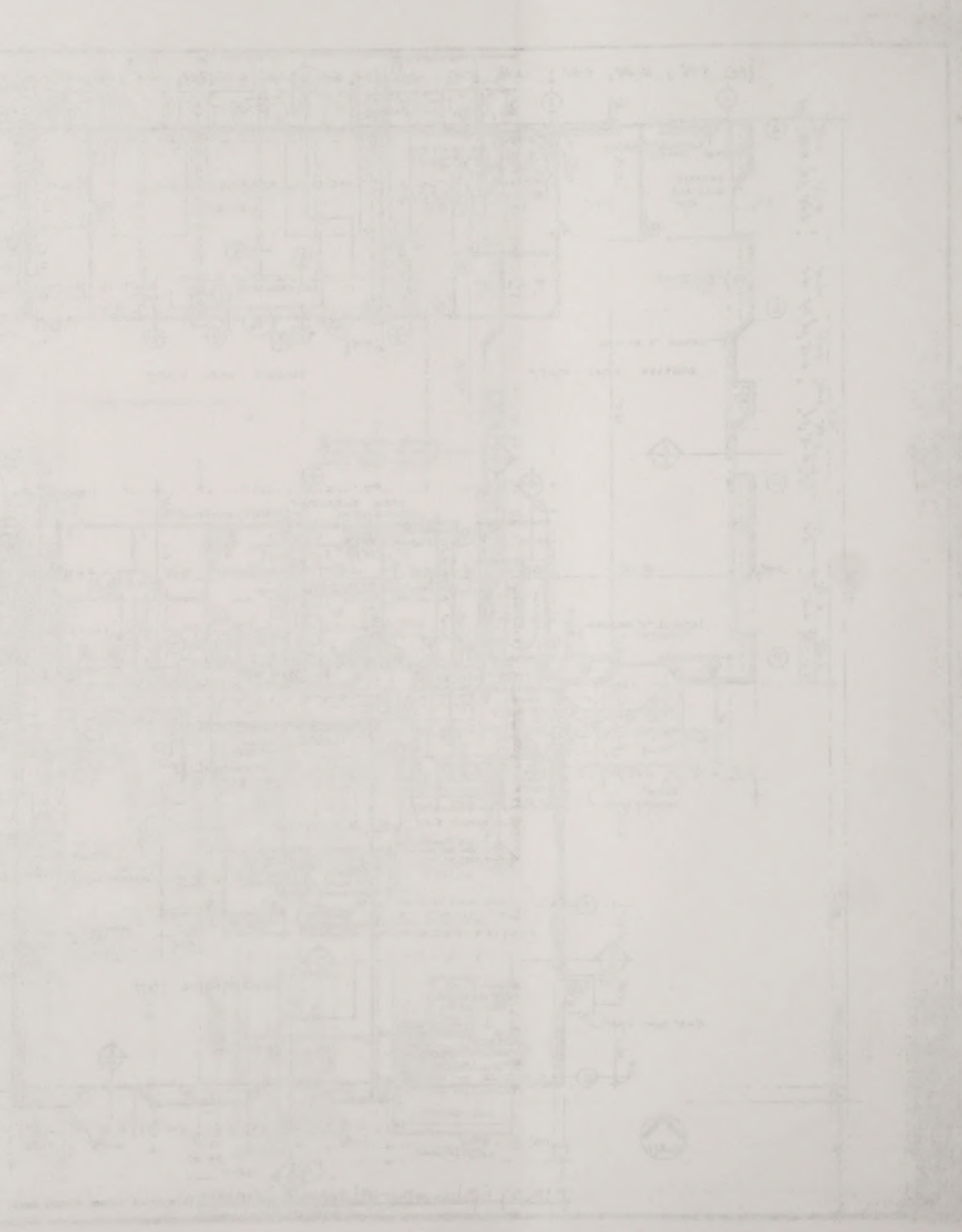
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING · DENVER SERVICE CENTER

FIRST FLOOR PLAN & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED ely
DRAWN
CHECKED ACY
RECOMMENDED
RECOMMENDED
APPROVED

SCALE 1/8" = 1'-0"
DATE JUNE 1978
SHEET 20 OF
DRAWING NO. YA-4000-9181

A1



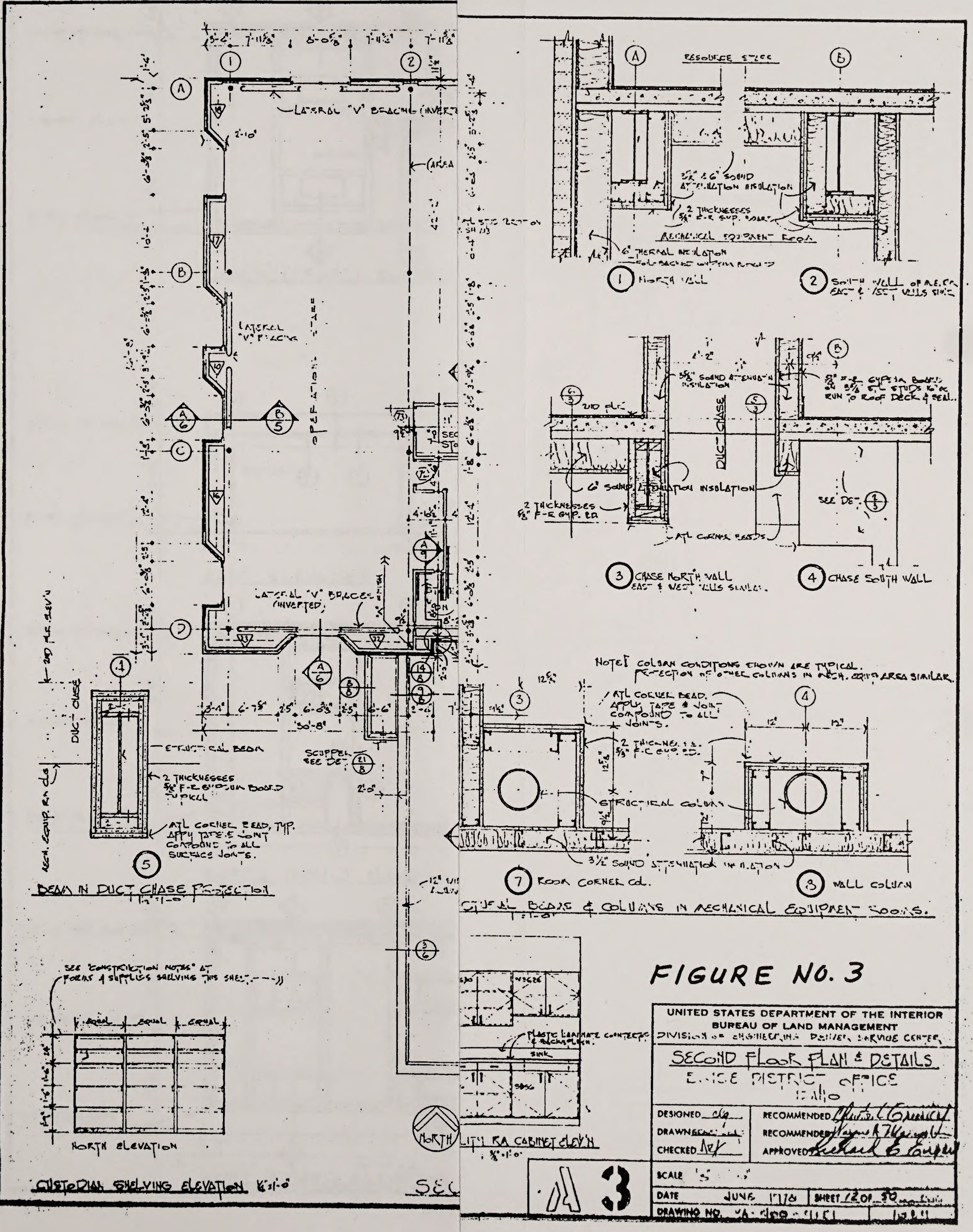

LATERAL "V" BRACING (INVERTED)
LATERAL "V" BRACING
LATERAL "V" BRACES (INVERTED)
2'-10"
2ND FLR. ELEV'N
DUCT CHASE
MECH. EQUIP. RM CLG
STRUCTURAL BEAM
2 THICKNESSES 5/8" F-R GYPSUM BOARD TYPICAL
ATL CORNER BEAD, TYP. APPLY TAPE & JOINT COMPOUND TO ALL SURFACE JOINTS.
5 BEAM IN DUCT CHASE PROTECTION 1 1/2"=1'-0"
SCUPPER SEE DET. 21/8
30'-8"
SEE "CONSTRUCTION NOTES" AT FORMS & SUPPLIES SHELVING THIS SHEET
EQUAL
EQUAL
EQUAL
NORTH ELEVATION
CUSTODIAL SHELVING ELEVATION 1/2"=1'-0"
NORTH
PLASTIC LAMINATE COUNTERTOP & BACKSPLASH
SINK
UTILITY RM CABINET ELEV'N 3/8"=1'-0"
SEC
RESOURCE STOR.
5/8" & 6" SOUND ATTENUATION INSOLATION
2 THICKNESSES 5/8" F-R GYP. BOARD
MECHANICAL EQUIPMENT ROOM
6" THERMAL INSULATION FOIL BACKED WITH FOIL EXPOSED
1 NORTH WALL
2 SOUTH WALL OF M.E.R. EAST & WEST WALLS SIMILAR
2'-2"
5/8" SOUND ATTENUATION INSULATION
5/8" F-R GYPSUM BOARD ON 3 5/8" STL STUDS 16" OC RUN TO ROOF DECK & SEAL.
2ND FLR.
DUCT CHASE
6" SOUND ATTENUATION INSOLATION
2 THICKNESSES 5/8" F-R GYP. BD
ATL CORNER BEADS
SEE DET. 4/5
3 CHASE NORTH WALL EAST & WEST WALLS SIMILAR.
4 CHASE SOUTH WALL
NOTE: COLUMN CONDITIONS SHOWN ARE TYPICAL. PROTECTION OF OTHER COLUMNS IN MECH. EQUIP. AREA SIMILAR.
ATL CORNER BEAD. APPLY TAPE & JOINT COMPOUND TO ALL JOINTS.
2 THICKNESSES 5/8" F-R GYP. BD.
STRUCTURAL COLUMN
3 1/2" SOUND ATTENUATION INSULATION
7 ROOM CORNER COL.
8 WALL COLUMN
STRUCTURAL BEAMS & COLUMNS IN MECHANICAL EQUIPMENT ROOMS. 1"=1'-0"
A 3

FIGURE NO. 3

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

SECOND FLOOR PLAN & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED clg
DRAWN [illegible]
CHECKED AEK
RECOMMENDED Charles C. Grinnell
RECOMMENDED Wayne A. Weinold
APPROVED Richard E. Eichner
SCALE [illegible]
DATE JUNE 1978
SHEET 12 OF 30
DRAWING NO. [illegible]

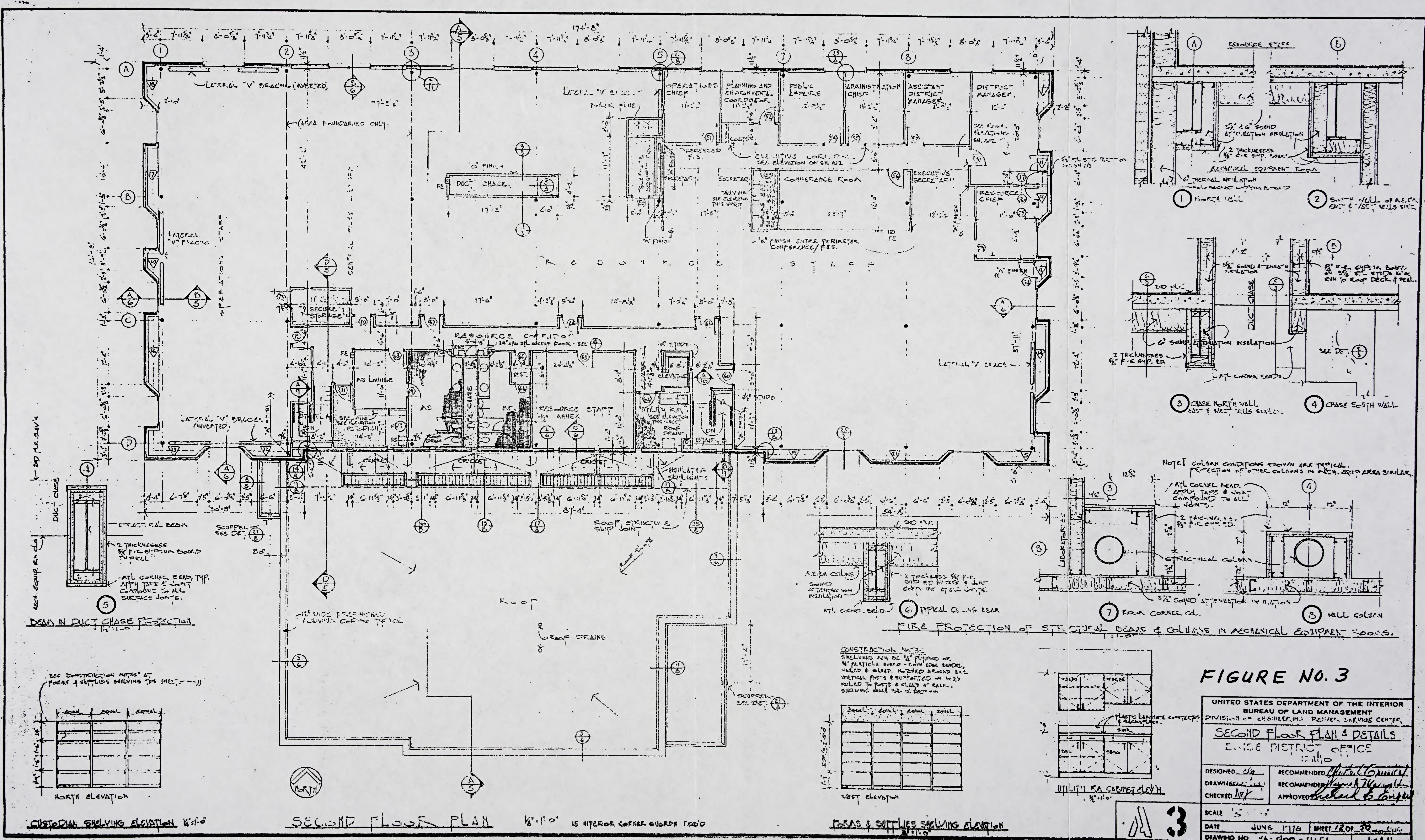

174'-8"
LATERAL "V" BRACING (INVERTED)
(AREA BOUNDARIES ONLY)
LATERAL "V" BRACING
LATERAL "V" BRACES (INVERTED)
DUCT CHASE
OPERATIONS CHIEF
PLANNING AND ENVIRONMENTAL COORDINATOR
PUBLIC AFFAIRS
ADMINISTRATION CHIEF
ASSISTANT DISTRICT MANAGER
DISTRICT MANAGER
RECESSED F.E.
EXECUTIVE CORRIDOR SEE ELEVATION ON SH. A12
SECRETARY
CONFERENCE ROOM
EXECUTIVE SECRETARY
RESOURCE CHIEF
"A" FINISH
"A" FINISH ENTIRE PERIMETER CONFERENCE/F&S.
SHELVING SEE ELEVATION THIS SHEET
R E S O U R C E   S T A F F
SECURE STORAGE
RESOURCE CORRIDOR
24"x36" STL ACCESS DOOR - SEE
AS LOUNGE
AS
PIPE CHASE
REST.
RESOURCE STAFF ANNEX
ELEVATOR
UTILITY RM SEE ELEVATION THIS SHEET
ROOF DRAIN
STAIR
DN
6" STUDS
2½" STUDS
CRICKET
INSULATING SKYLIGHTS
87'-4"
54'-8"
ROOF STRUCTURE SLIP JOINT
ROOF SLOPE
SCUPPER SEE DET.
12" WIDE PREFINISHED FLASHING COPING TYPICAL
ROOF
ROOF DRAINS
NORTH
SECOND FLOOR PLAN 1/8"=1'-0"
15 INTERIOR CORNER GUARDS REQ'D
DUCT CHASE
STRUCTURAL BEAM
2 THICKNESSES 5/8" F-C GYPSUM BOARD TYPICAL
ATL CORNER BEAD, TYP. APPLY TAPE & JOINT COMPOUND TO ALL SURFACE JOINTS.
5 BEAM IN DUCT CHASE PROTECTION 1 1/2"=1'-0"
SEE CONSTRUCTION NOTES AT FORMS & SUPPLIES SHELVING THIS SHEET
equal equal equal
NORTH ELEVATION
CUSTODIAN SHELVING ELEVATION ½"=1'-0"
RESOURCE STAFF
5/8" x 6" SOUND ATTENUATION INSULATION
2 THICKNESSES 5/8" F-C GYP. BOARD
MECHANICAL EQUIPMENT ROOM
6" THERMAL INSULATION
1 NORTH WALL
2 SOUTH WALL OF M.E.R. EAST & WEST WALLS SIM.
5/8" SOUND ATTENUATION INSULATION
6" SOUND ATTENUATION INSULATION
2 THICKNESSES 5/8" F-C GYP. BD
ATL CORNER BEADS
SEE DET.
3 CHASE NORTH WALL EAST & WEST WALLS SIMILAR
4 CHASE SOUTH WALL
NOTE: COLUMN CONDITIONS SHOWN ARE TYPICAL. PROTECTION OF OTHER COLUMNS IN MECH. EQUIP. AREA SIMILAR.
ATL CORNER BEAD. APPLY TAPE & JOINT COMPOUND TO ALL JOINTS.
2 THICKNESSES 5/8" F-C GYP. BD.
STRUCTURAL COLUMN
3½" SOUND ATTENUATION INSULATION
LABORATORIES
7 ROOM CORNER COL.
8 WALL COLUMN
M.E.R. CEILING
SOUND ATTENUATION INSULATION
2 THICKNESSES 5/8" F-C GYP BD WITH ATL CORNER
ATL CORNER BEAD
6 TYPICAL CEILING BEAM
FIRE PROTECTION OF STRUCTURAL BEAMS & COLUMNS IN MECHANICAL EQUIPMENT ROOMS. 1"=1'-0"
CONSTRUCTION NOTES:
SHELVING MAY BE ¾" PLYWOOD OR ¾" PARTICLE BOARD - BOTH EDGE BANDED, NAILED & GLUED. NOTCHED AROUND 2x2 VERTICAL POSTS & SUPPORTED ON 1x2'S NAILED TO POSTS & CLEATS AT REAR. SHELVING SHALL BE 12" DEEP MIN.
equal equal equal equal
WEST ELEVATION
FORMS & SUPPLIES SHELVING ELEVATION ½"=1'-0"
PLASTIC LAMINATE COUNTERTOP & BACKSPLASH
SINK
UTILITY RM CABINET ELEV'N ½"=1'-0"
A3

FIGURE NO. 3

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

SECOND FLOOR PLAN & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED ____
DRAWN ____
CHECKED ____
RECOMMENDED ____
RECOMMENDED ____
APPROVED Richard E. Eaton

SCALE ____
DATE JUNE 1976
SHEET 12 OF 30
DRAWING NO. ____

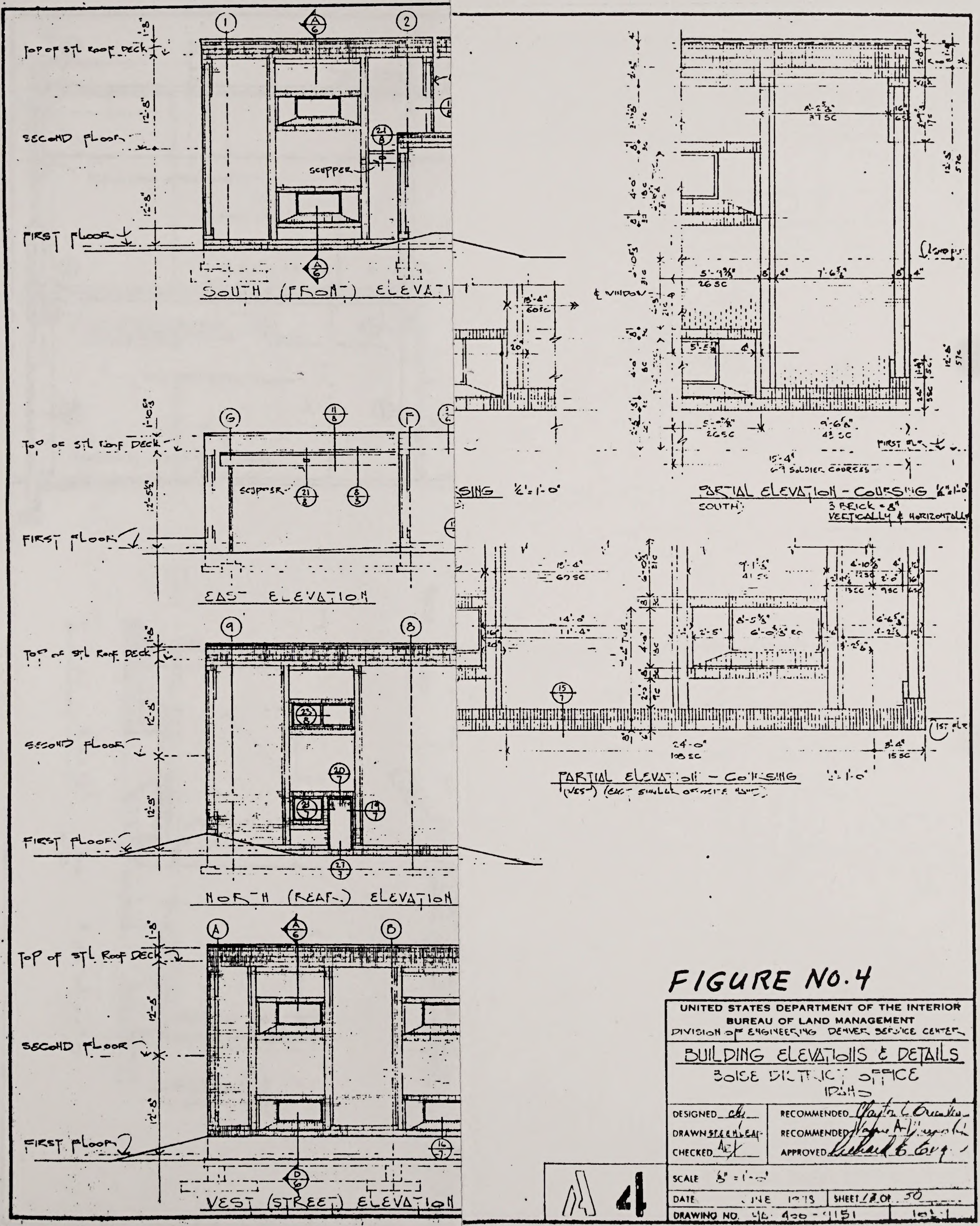

SOUTH (FRONT) ELEVATION
EAST ELEVATION
NORTH (REAR) ELEVATION
WEST (STREET) ELEVATION
TOP OF STL ROOF DECK
SECOND FLOOR
FIRST FLOOR
SCUPPER
PARTIAL ELEVATION - COURSING 1/2"=1'-0"
(SOUTH)
3 BRICK = 8" VERTICALLY & HORIZONTALLY
PARTIAL ELEVATION - COURSING 1/2"=1'-0"
(WEST) (EAST SIMILAR OPPOSITE HAND)
15'-4" 69 SOLDIER COURSES
24'-0" 108 SC
℄ WINDOW

FIGURE NO. 4

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

BUILDING ELEVATIONS & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED ck
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

SCALE 1/8" = 1'-0"
DATE JUNE 1978
SHEET 17 OF 50
DRAWING NO. 46-400-1151

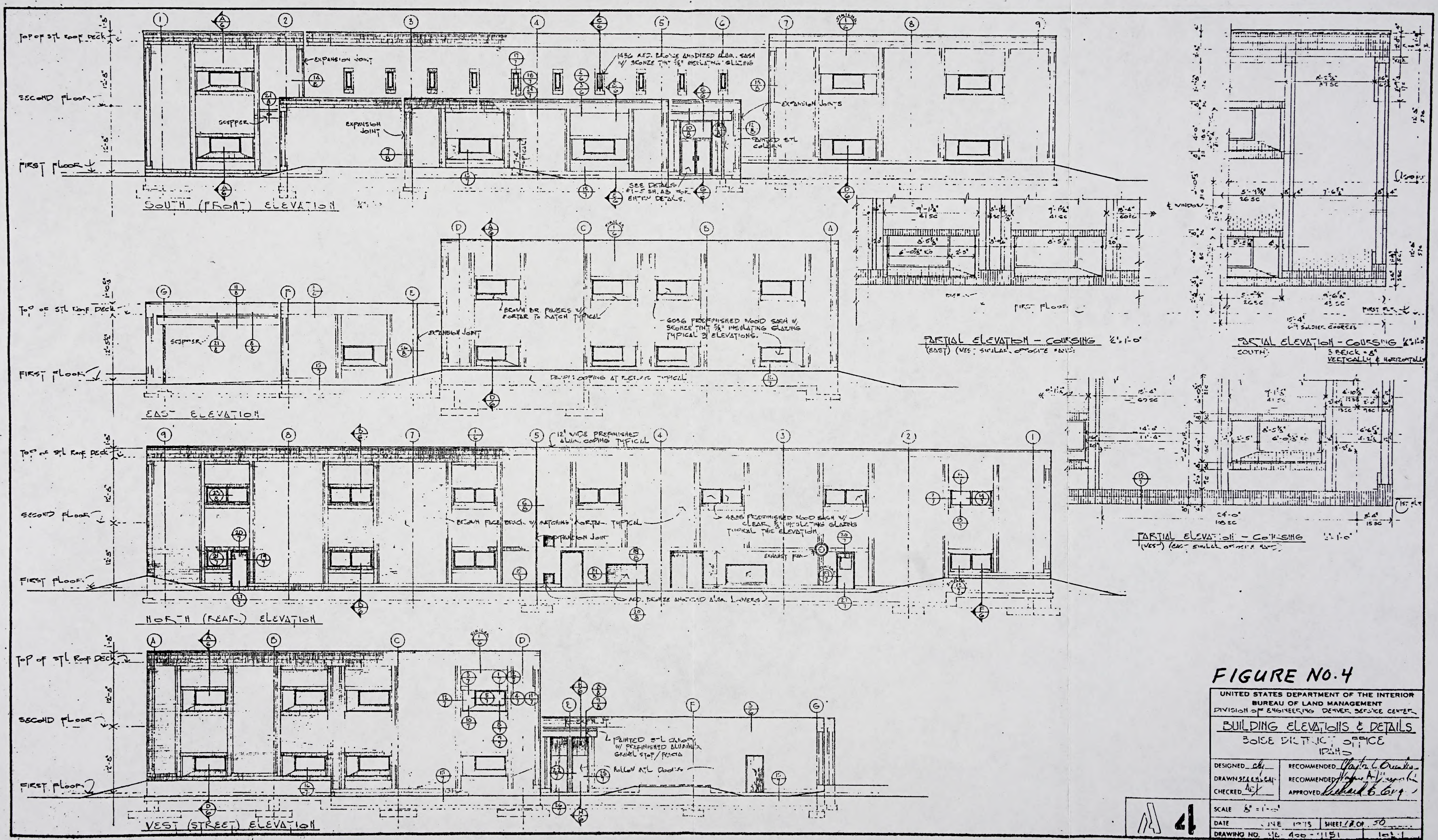

TOP OF STL ROOF DECK
SECOND FLOOR
FIRST FLOOR
EXPANSION JOINT
SCUPPER
EXPANSION JOINT
1436 AEJ. BRONZE ANODIZED ALUM. SASH W/ BRONZE TINT 5/8" INSULATING GLAZING
EXPANSION JOINTS
PAINTED STL COLUMN
SEE DETAILS #1-5 SH. A8 FOR ENTRY DETAILS.
7'-4" TYPICAL
SOUTH (FRONT) ELEVATION
TOP OF STL ROOF DECK
SCUPPER
EXPANSION JOINT
BROWN BR. PAVERS W/ MORTAR TO MATCH TYPICAL
6036 PREFINISHED WOOD SASH W/ BRONZE TINT 5/8" INSULATING GLAZING TYPICAL 3 ELEVATIONS.
FIRST FLOOR
EAST ELEVATION
12" WIDE PREFINISHED ALUM. COPING TYPICAL
TOP OF STL ROOF DECK
SECOND FLOOR
BROWN FACE BRICK W/ MATCHING MORTAR TYPICAL
EXPANSION JOINT
4886 PREFINISHED WOOD SASH W/ CLEAR 5/8" INSULATING GLAZING TYPICAL THIS ELEVATION
EXHAUST FAN
AEJ. BRONZE ANODIZED ALUM. LOUVERS
FIRST FLOOR
NORTH (REAR) ELEVATION
TOP OF STL ROOF DECK
SECOND FLOOR
PAINTED STL CANOPY W/ PREFINISHED ALUMINUM GRAVEL STOP/FASCIA
HOLLOW MTL DOORS
FIRST FLOOR
WEST (STREET) ELEVATION
9'-1 3/8" 41 SC
3'-1 1/4"
9'-1 1/2" 41 SC
13'-4" 60 SC
8'-5 5/8"
6'-0 5/8" CO
2'-5"
FIRST FLOOR
PARTIAL ELEVATION - COURSING 1/2"=1'-0"
(EAST) (WEST SIMILAR, OPPOSITE HAND)
℄ WINDOW
5'-9 3/8" 26 SC
7'-6 5/8"
5'-0 5/8" 26 SC
9'-6 5/8" 43 SC
FIRST FLR
15'-4" 69 SOLDIER COURSES
PARTIAL ELEVATION - COURSING 1/2"=1'-0"
SOUTH
3 BRICK = 8" VERTICALLY & HORIZONTALLY
13'-4" 60 SC
14'-0"
11'-4"
7'-1 5/8" 41 SC
4'-10 3/8"
8'-5 5/8"
6'-0 5/8" CO
6'-6 5/8"
24'-0" 108 SC
3'-4" 15 SC
PARTIAL ELEVATION - COURSING 1/2"=1'-0"
(WEST) (EAST SIMILAR, OPPOSITE HAND)
4

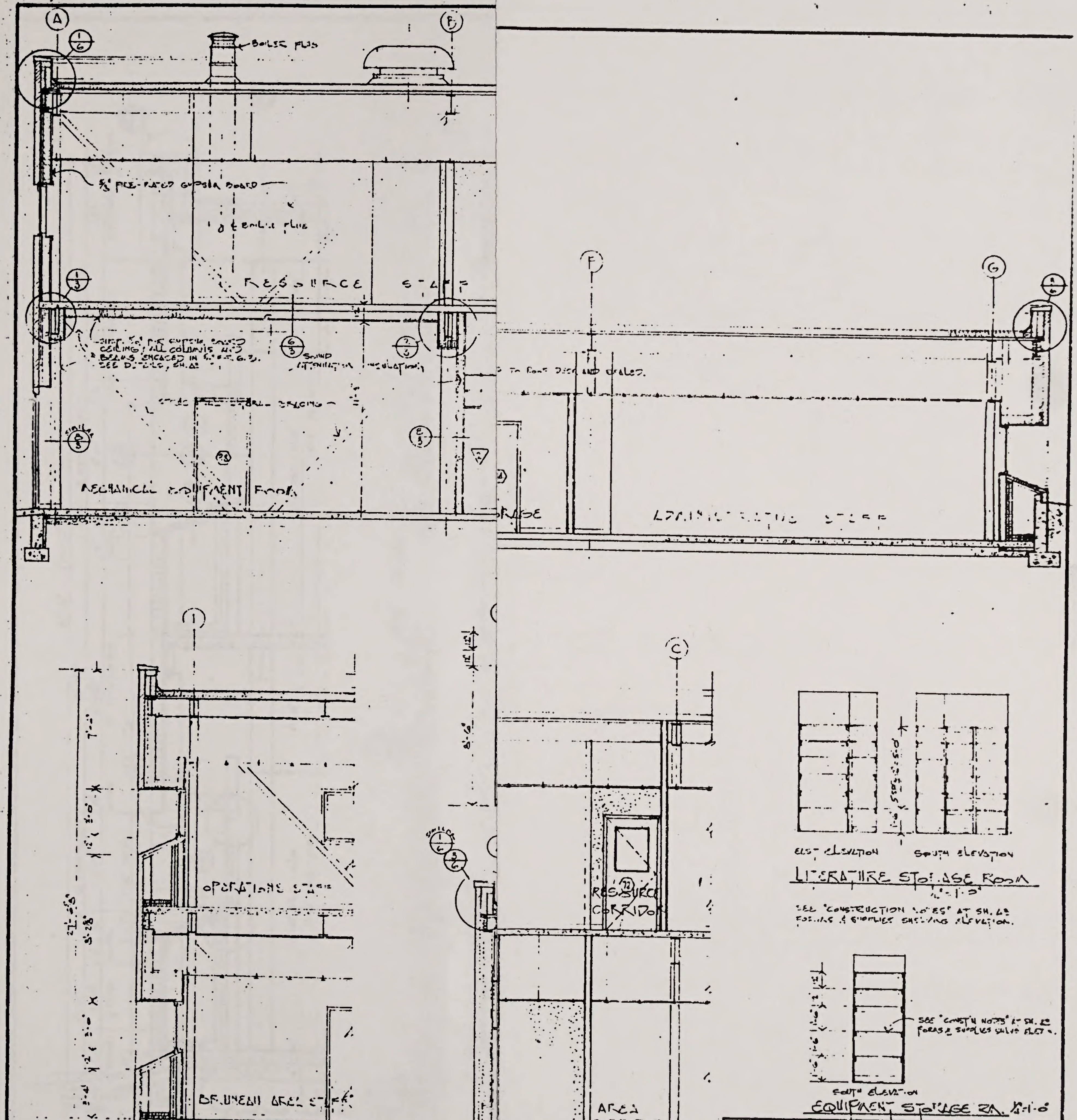
FIGURE NO. 4

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

BUILDING ELEVATIONS & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED ch
DRAWN
CHECKED
RECOMMENDED Clayton L. Crowley
RECOMMENDED Wayne A.
APPROVED Richard E. Corey

SCALE 1/8" = 1'-0"
DATE JUNE 1975
SHEET 13 OF 50
DRAWING NO. ID 400-1151



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

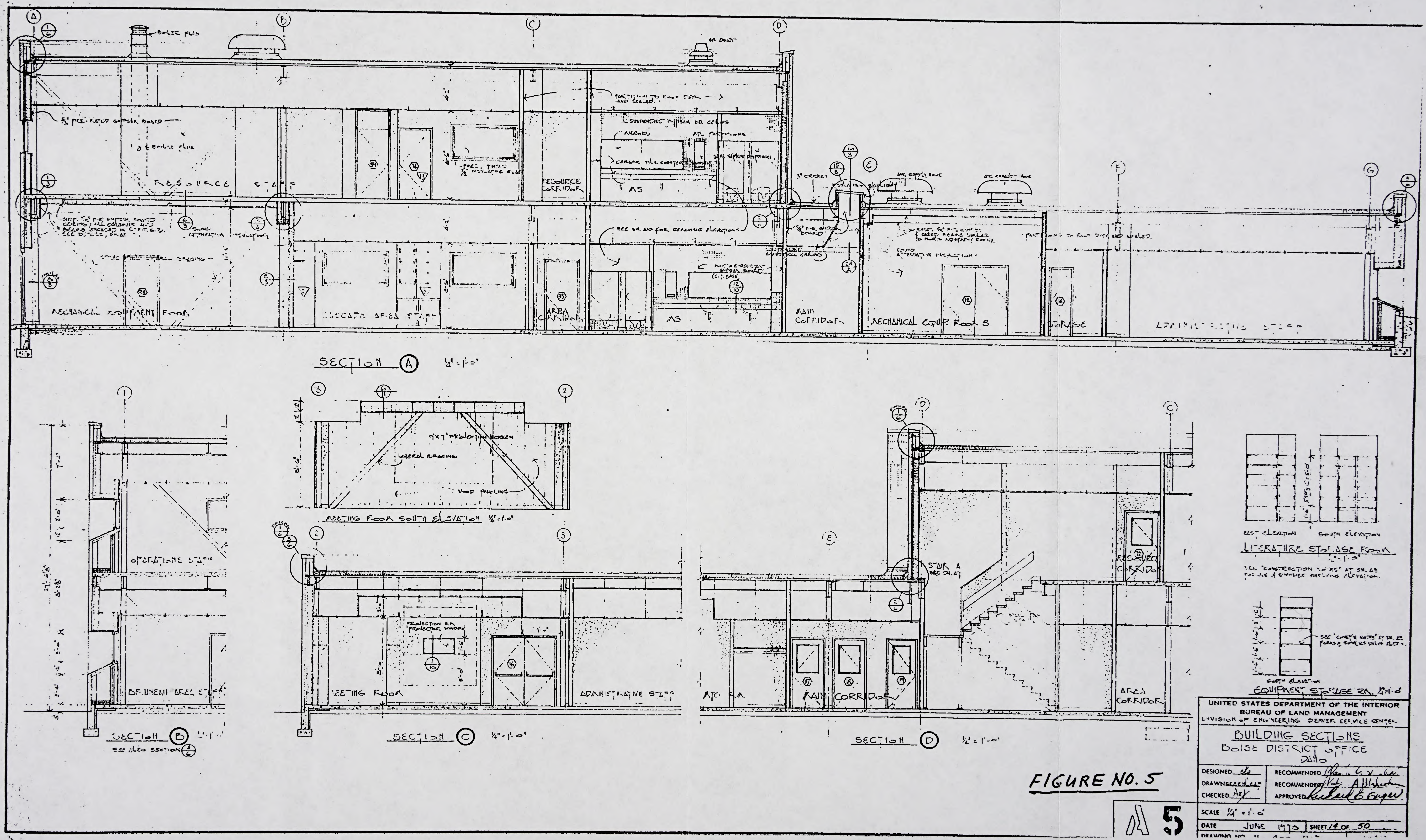
BUILDING SECTIONS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cls
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

SCALE 1/4" = 1'-0"
DATE JUNE 1975
SHEET 14 OF 50

GURE NO. 5

A 5



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

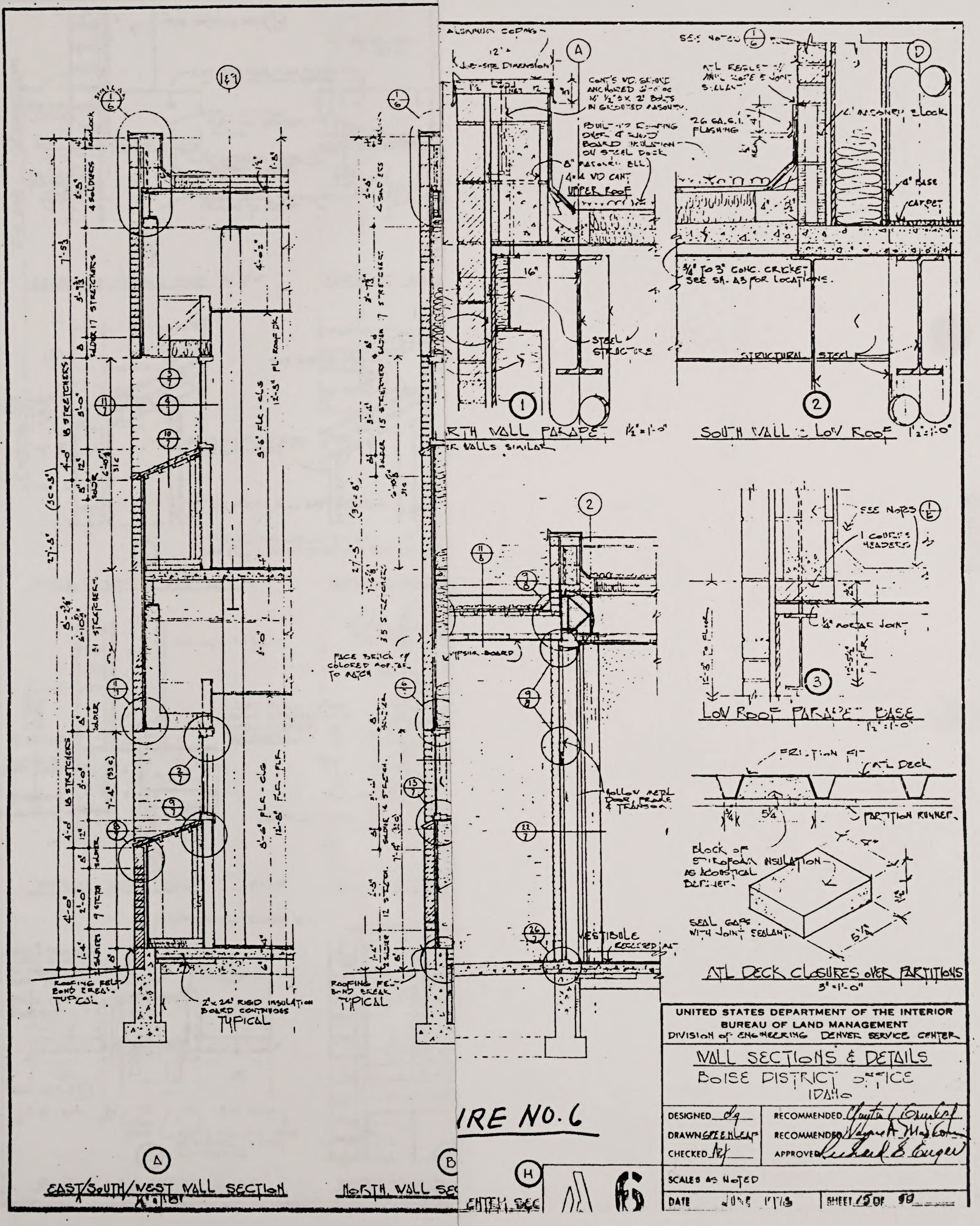
BUILDING SECTIONS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cls
DRAWN
CHECKED ACY
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Gager

SCALE 1/4" = 1'-0"
DATE JUNE 1975
SHEET 14 OF 50

A 5

FIGURE NO. 5


EAST/SOUTH/WEST WALL SECTION
NORTH WALL SEC
ENTRY SEC
ALUMINUM COPING
12'±
JOB-SITE DIMENSION
CONT'S WD. GROUND ANCHORED @ 4'-0" OC W/ ½" x 2" BOLTS IN GROUTED MASONRY
BUILT-UP ROOFING OVER 4" RIGID BOARD INSULATION ON STEEL DECK
8" MASONRY BLL.
4×4 WD CANT
UPPER ROOF
16"
STEEL STRUCTURE
NORTH WALL PARAPET 1½"=1'-0"
OTHER WALLS SIMILAR
SEE NOTE
ATL REGLET W/ ANG. ROPE & JOINT SEALANT
26 GA. G.I. FLASHING
4" MASONRY BLOCK
4" BASE
CARPET
¾" TO 3" CONC. CRICKET SEE SA-A3 FOR LOCATIONS.
STRUCTURAL STEEL
SOUTH WALL @ LOW ROOF 1½"=1'-0"
SEE NOTES
1 COURSE HEADERS
½" MORTAR JOINT
LOW ROOF PARAPET BASE 1½"=1'-0"
FRICTION FIT
ATL DECK
PARTITION RUNNER
BLOCK OF STYROFOAM INSULATION AS ACOUSTICAL BARRIER.
SEAL GAPS WITH JOINT SEALANT
ATL DECK CLOSURES OVER PARTITIONS 3"=1'-0"
FACE BRICK W/ COLORED MORTAR TO MATCH
GYPSUM BOARD
HOLLOW METAL DOOR FRAME & TRANSOM
VESTIBULE
RECESSED MAT
ROOFING FELT BOND BREAK TYPICAL
2"×24" RIGID INSULATION BOARD CONTINUOUS TYPICAL
17 STRETCHERS
18 STRETCHERS
21 STRETCHERS
15 STRETCHERS
35 STRETCHERS
7 STRETCHERS
9 STRETCHERS
12 STRETCHERS
4 SOLDIERS
SOLDIER
ROWLOCK
27'-8"
PL-ROOF DK
FLR-CLG
PLR-CLG
FLR-FLR
A
B
H
1
2
3
D

IRE NO. 6

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION of ENGINEERING DENVER SERVICE CENTER

WALL SECTIONS & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED dg	RECOMMENDED
DRAWN GREENLEAF	RECOMMENDED
CHECKED RJ	APPROVED

SCALES AS NOTED

DATE JUNE 1978 SHEET 15 OF 50

A6

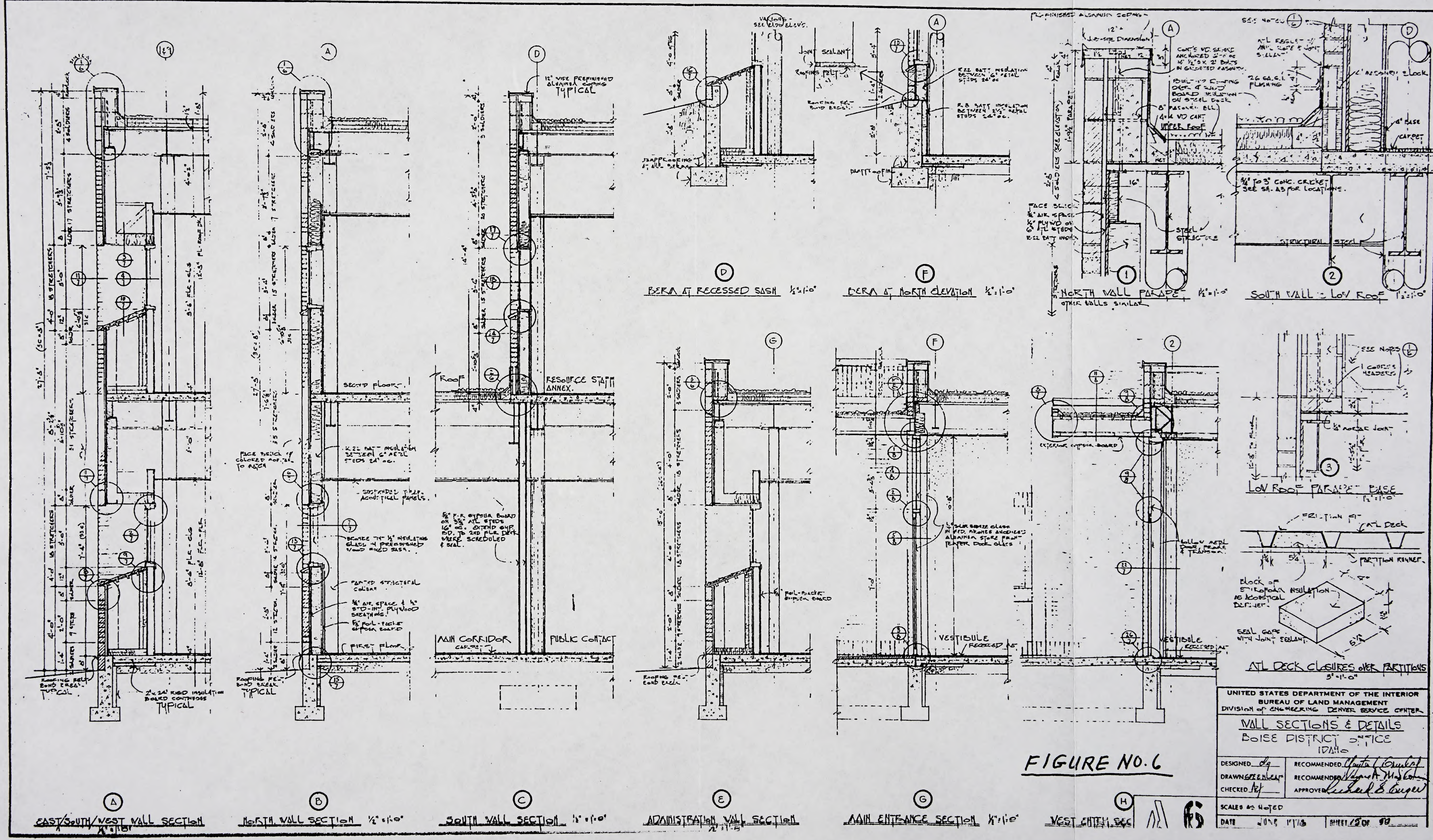

Ⓐ EAST/SOUTH/WEST WALL SECTION ½"=1'-0"
Ⓑ NORTH WALL SECTION ½"=1'-0"
Ⓒ SOUTH WALL SECTION ½"=1'-0"
Ⓔ ADMINISTRATION WALL SECTION ½"=1'-0"
Ⓖ MAIN ENTRANCE SECTION ½"=1'-0"
Ⓗ WEST ENTRY SEC
Ⓓ BERM AT RECESSED SASH ½"=1'-0"
Ⓕ BERM AT NORTH ELEVATION ½"=1'-0"
① NORTH WALL PARAPET 1½"=1'-0" OTHER WALLS SIMILAR
② SOUTH WALL @ LOW ROOF 1½"=1'-0"
③ LOW ROOF PARAPET BASE 1½"=1'-0"
MTL DECK CLOSURES OVER PARTITIONS 3"=1'-0"
12" WIDE PREFINISHED ALUMINUM COPING TYPICAL
SECOND FLOOR
FIRST FLOOR
ROOF
RESOURCE STAFF ANNEX
MAIN CORRIDOR
PUBLIC CONTACT
VESTIBULE
ROOFING FELT BOND BREAK TYPICAL
2"x24" RIGID INSULATION BOARD CONTINUOUS TYPICAL
FACE BRICK OF COLORED MORTAR TO MATCH
R-22 BATT INSULATION BETWEEN 6" METAL STUDS 24" O.C.
SUSPENDED TILE ACOUSTICAL PANELS
BRONZE TINT ½" INSULATING GLASS IN PREFINISHED WOOD FIXED SASH
PAINTED STRUCTURAL COLUMN
⅝" FOIL-BACKED GYPSUM BOARD
JOINT SEALANT
STEEL STRUCTURE
STRUCTURAL STEEL
26 GA. G.I. FLASHING
4" MASONRY BLOCK
4" BASE
CARPET
¾" TO 3" CONC. CRICKET SEE SA-A3 FOR LOCATIONS
UPPER ROOF
FRICTION FIT
MTL DECK
PARTITION RUNNER
BLOCK OF STYROFOAM INSULATION AS ACOUSTICAL DEFLECTOR
SEAL GAPS WITH JOINT SEALANT
HOLLOW METAL DOOR FRAME & TRANSOM
EXTERIOR GYPSUM BOARD

FIGURE NO. 6

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION of ENGINEERING DENVER SERVICE CENTER

WALL SECTIONS & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED dg
DRAWN GREENLEAF
CHECKED Ref
RECOMMENDED Chester L Crowfoot
RECOMMENDED Wayne A. Mackenzie
APPROVED Richard E. Eager

SCALES AS NOTED
DATE JUNE 1973
SHEET 15 OF 50

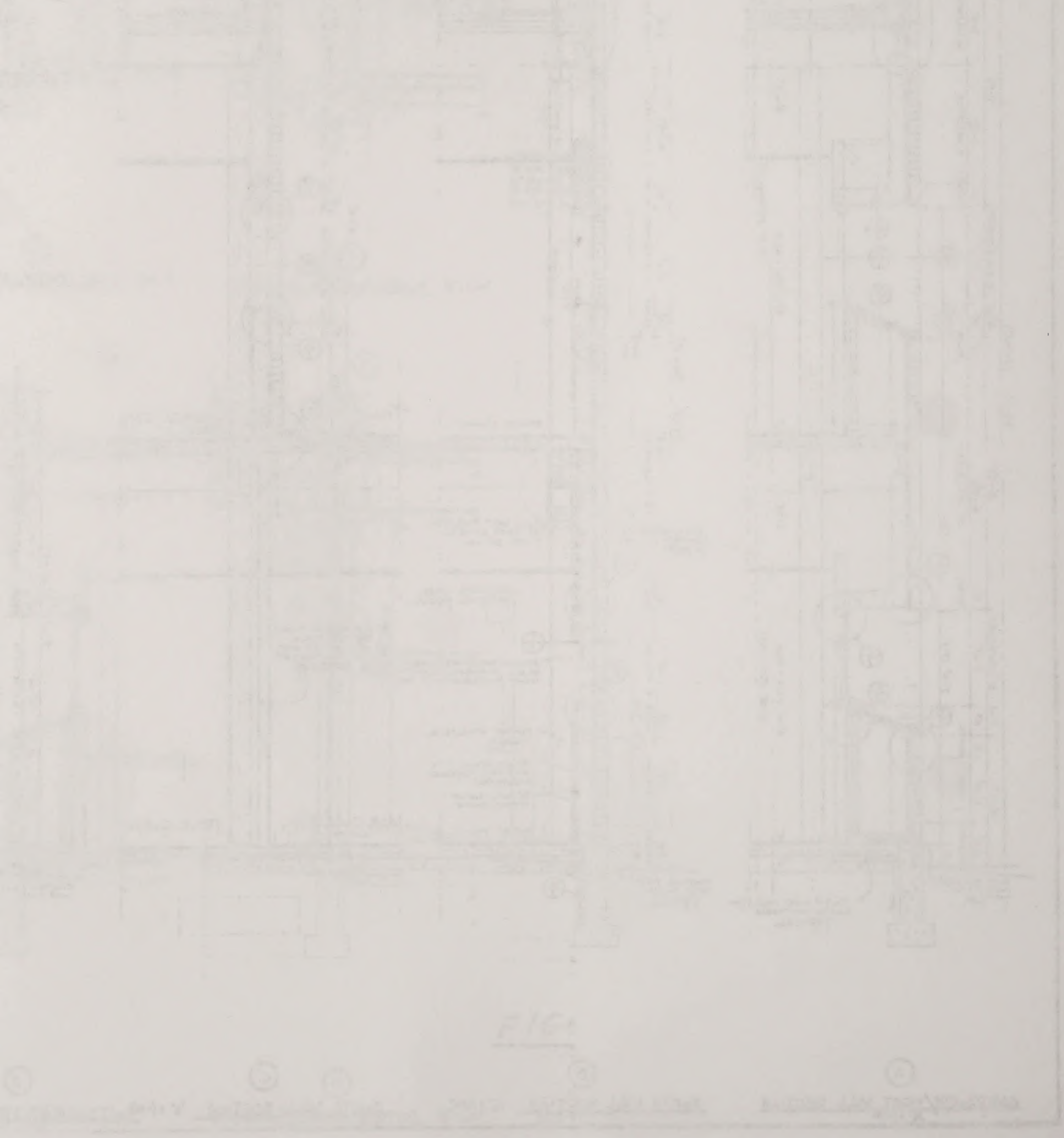


FIG.

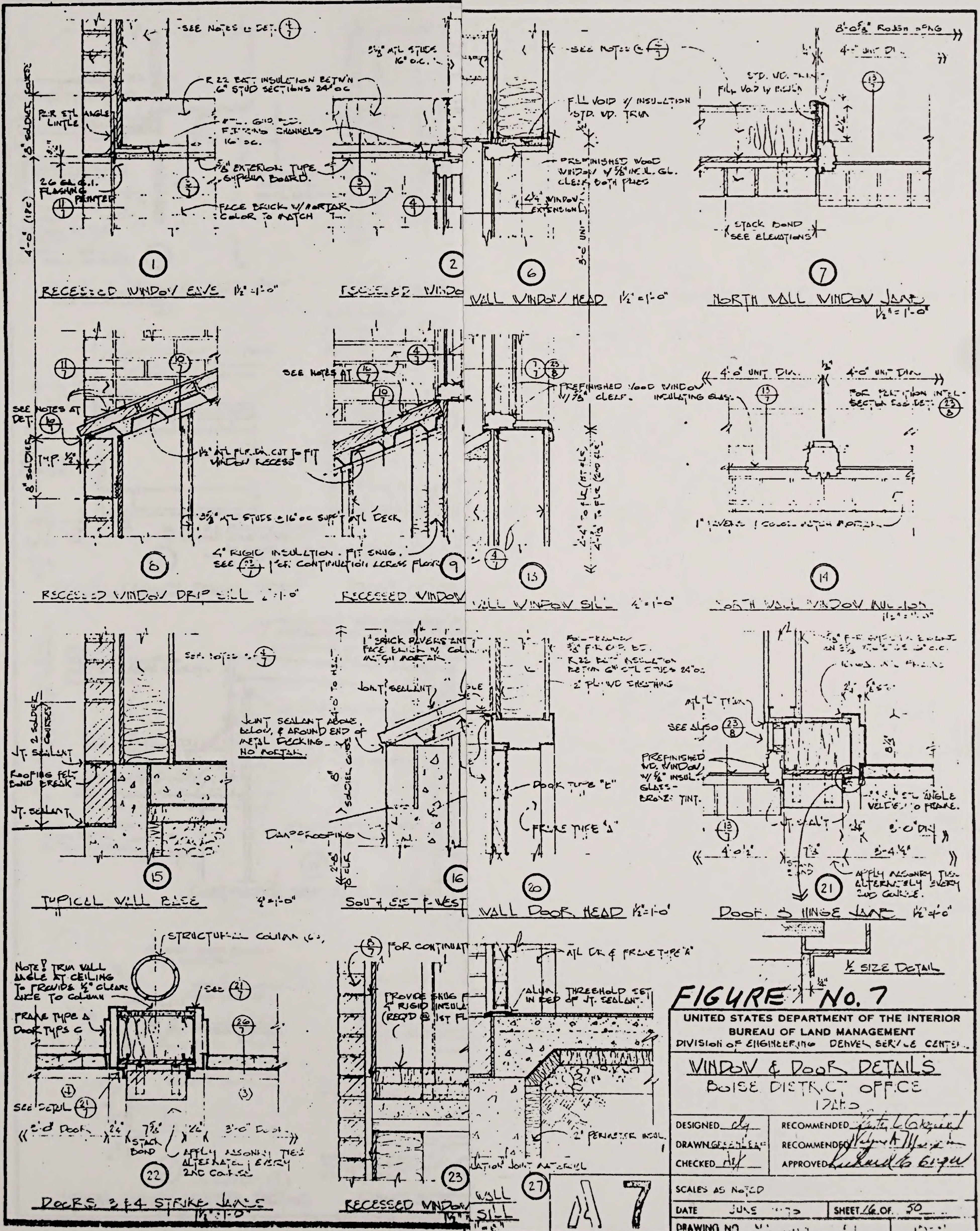
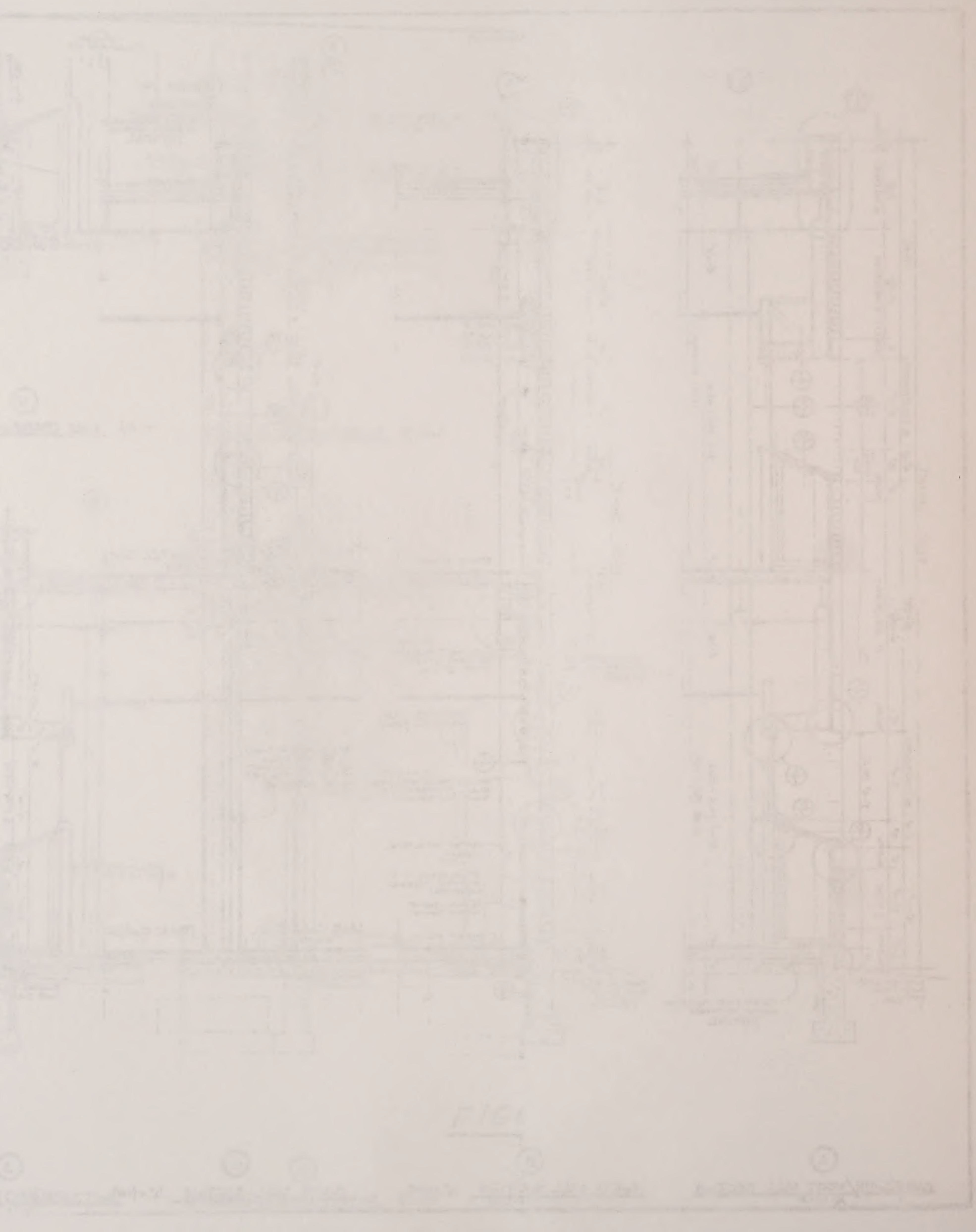

SEE NOTES @ DET. 4/7
3⅝" MTL STUDS 16" O.C.
R 22 BATT INSULATION BETW'N 6" STUD SECTIONS 24" OC
PAIR STL ANGLE LINTLE
MTL. GRID SUSP. FURRING CHANNELS 16" OC.
⅝" EXTERIOR TYPE GYPSUM BOARD.
26 GA. G.I. FLASHING PAINTED
FACE BRICK W/ MORTAR COLOR TO MATCH
1'-8" SOLDIER COURSE
4'-0" (12C)
1
RECESSED WINDOW EAVE 1½"=1'-0"
2
RECESSED WINDO
FILL VOID W/ INSULATION
STD. WD. TRIM
PREFINISHED WOOD WINDOW W/ ⅝" INSUL. GL. CLEAR BOTH PANES
4¼" WINDOW EXTENSION
6
WALL WINDOW HEAD 1½"=1'-0"
8'-0⅝" ROUGH OPNG
4'-0" UNIT DIM.
STD. WD. TRIM
FILL VOID W/ INSUL.
STACK BOND SEE ELEVATIONS
7
NORTH WALL WINDOW JAMB 1½"=1'-0"
SEE NOTES AT DET. 10/7
TYP. ½"
8" SOLDIER
½" MTL FLR. DK. CUT TO FIT WINDOW RECESS
3⅝" MTL STUDS @ 16" OC SUPP'T MTL DECK
4" RIGID INSULATION. FIT SNUG. SEE 23/7 FOR CONTINUATION ACROSS FLOOR
8
RECESSED WINDOW DRIP SILL 1"=1'-0"
SEE NOTES AT 16/7
9
RECESSED WINDOW
PREFINISHED WOOD WINDOW W/ ⅝" CLEAR INSULATING GLASS
13
WALL WINDOW SILL 1"=1'-0"
4'-0" UNIT DIM.
FOR PARTITION INTERSECTION SEE DET. 23/8
1" PAVERS & COLOR MATCH MORTAR
14
NORTH WALL WINDOW MULLION 1½"=1'-0"
SEE NOTES 4/7
2 SOLDIER COURSES
JT. SEALANT
ROOFING FELT BOND BREAK
JT. SEALANT
15
TYPICAL WALL BASE 1"=1'-0"
1" BRICK PAVERS AND FACE BRICK W/ COLOR MATCH MORTAR
JOINT SEALANT
JOINT SEALANT ABOVE, BELOW, & AROUND END OF METAL DECKING. NO MORTAR.
DAMPPROOFING
16
SOUTH, EAST & WEST
⅝" FIRECODE BD.
R 22 BATT INSULATION BETW'N 6" STL STUDS 24" OC
½" PLYWD SHEATHING
DOOR TYPE "C"
FRAME TYPE "A"
20
WALL DOOR HEAD 1½"=1'-0"
MTL "L" TRIM
SEE ALSO 23/8
PREFINISHED WD. WINDOW W/ ⅝" INSUL. GLASS - BRONZE TINT.
STL ANGLE WELDED TO FRAME
3'-0" DIM
5'-4¼"
4'-0½"
7⅝"
APPLY MASONRY TIES ALTERNATELY EVERY 2ND COURSE.
21
DOOR 3 HINGE JAMB 1½"=1'-0"
½ SIZE DETAIL
STRUCTURAL COLUMN
NOTE! TRIM WALL ANGLE AT CEILING TO PROVIDE ½" CLEARANCE TO COLUMN
FRAME TYPE A
DOOR TYPE C
SEE 21/7
SEE DETAIL 21/7
3'-0" DOOR
7⅝" STACK BOND
3'-0" DOOR
APPLY MASONRY TIES ALTERNATELY EVERY 2ND COURSE
22
DOORS 3 & 4 STRIKE JAMB 1½"=1'-0"
8/7 FOR CONTINUATION
PROVIDE SNUG FIT 4" RIGID INSULATION (REQ'D @ 1ST FL)
23
RECESSED WINDOW
MTL DR & FRAME TYPE "A"
ALUM. THRESHOLD SET IN BED OF JT. SEALANT.
2" PERIMETER INSUL.
EXPANSION JOINT MATERIAL
27
WALL SILL
A 7

FIGURE No. 7

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

WINDOW & DOOR DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cly
DRAWN GREENLEAF
CHECKED HK
RECOMMENDED
RECOMMENDED
APPROVED
SCALES AS NOTED
DATE JUNE
SHEET 16 OF 50
DRAWING NO



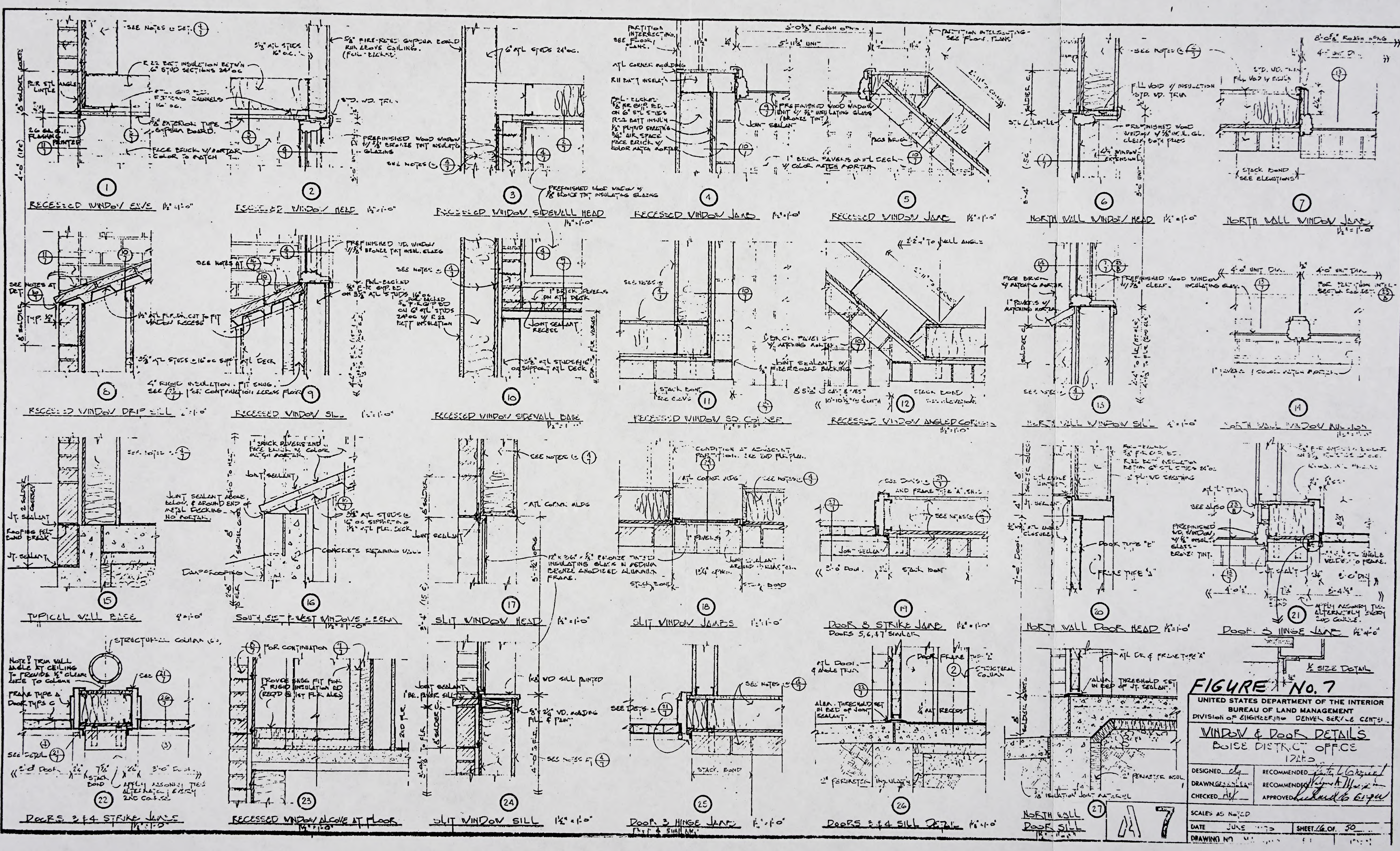

1
RECESSED WINDOW EAVE 1½"=1'-0"
2
RECESSED WINDOW HEAD 1½"=1'-0"
3
RECESSED WINDOW SIDEWALL HEAD 1½"=1'-0"
4
RECESSED WINDOW JAMB 1½"=1'-0"
5
RECESSED WINDOW JAMB 1½"=1'-0"
6
NORTH WALL WINDOW HEAD 1½"=1'-0"
7
NORTH WALL WINDOW JAMB 1½"=1'-0"
8
RECESSED WINDOW DRIP SILL
9
RECESSED WINDOW SILL 1½"=1'-0"
10
RECESSED WINDOW SIDEWALL BASE 1½"=1'-0"
11
RECESSED WINDOW SQ. CORNER 1½"=1'-0"
12
RECESSED WINDOW ANGLED CORNER 1½"=1'-0"
13
NORTH WALL WINDOW SILL 1½"=1'-0"
14
NORTH WALL WINDOW MULLION
15
TYPICAL WALL BASE
16
SOUTH, EAST & WEST WINDOWS @ BERM 1½"=1'-0"
17
SLIT WINDOW HEAD 1½"=1'-0"
18
SLIT WINDOW JAMBS 1½"=1'-0"
19
DOOR 8 STRIKE JAMB 1½"=1'-0"
DOORS 5, 6, & 7 SIMILAR
20
NORTH WALL DOOR HEAD 1½"=1'-0"
21
DOOR 3 HINGE JAMB 1½"=1'-0"
½ SIZE DETAIL
22
DOORS 3 & 4 STRIKE JAMBS 1½"=1'-0"
23
RECESSED WINDOW ALCOVE AT FLOOR 1½"=1'-0"
24
SLIT WINDOW SILL 1½"=1'-0"
25
DOOR 3 HINGE JAMB 1½"=1'-0"
1 & 2 SIMILAR
26
DOORS 3 & 4 SILL DETAIL 1½"=1'-0"
27
NORTH WALL DOOR SILL
A7

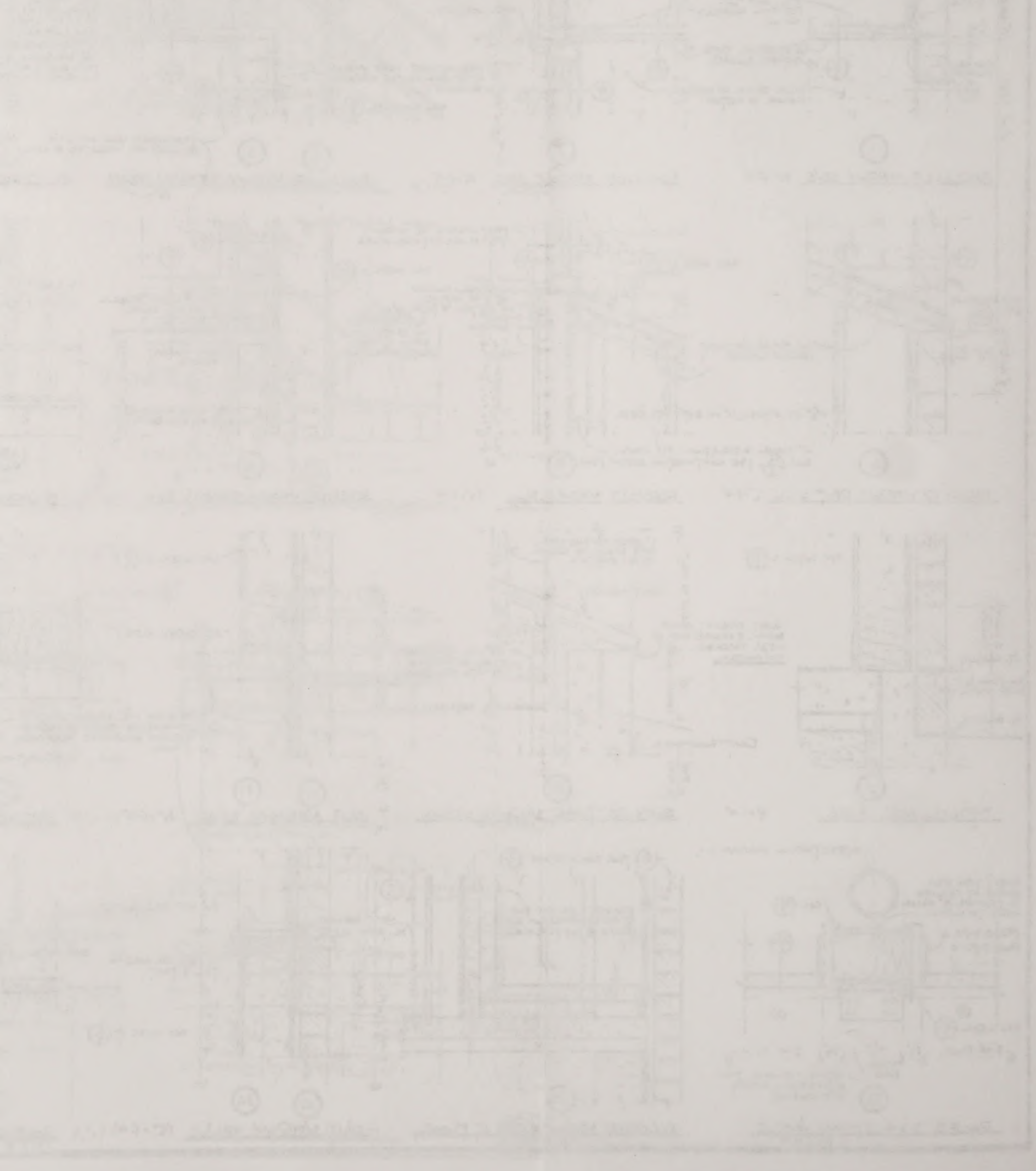
FIGURE No. 7

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

WINDOW & DOOR DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cly
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard G. Ginger

SCALES AS NOTED
DATE JUNE
SHEET 16 OF 50
DRAWING NO



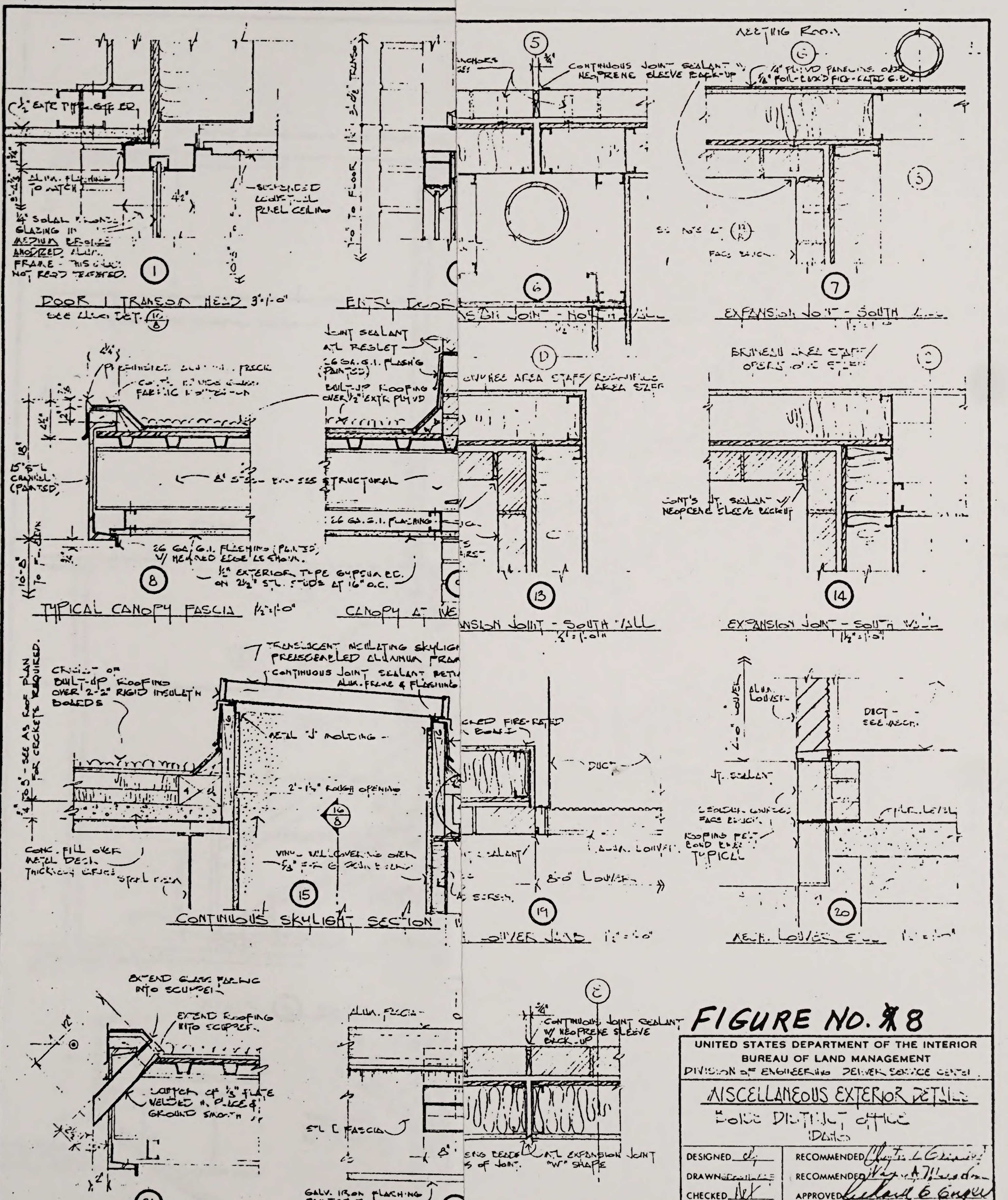

DOOR / TRANSOM HEAD 3" = 1'-0"
SEE ALUM. DET. 10/8
1/4" SOLAR BRONZE GLAZING IN MEDIUM BRONZE ANODIZED ALUM. FRAME - THIS GLASS NOT REQ'D TEMPERED.
ALUM. FLASHING TO MATCH
SUSPENDED ACOUSTICAL PANEL CEILING
4 1/2"
1
ANCHORS
CONTINUOUS JOINT SEALANT W/ NEOPRENE SLEEVE BACK-UP
5
6
MEETING ROOM
1/4" PLYWD PANELING OVER 5/8" FOIL-BACKED FIRE-RATED G.B.
SEE NOTE AT 12/8
FACE BRICK
7
EXPANSION JOINT - SOUTH WALL
JOINT SEALANT AT REGLET
26 GA. G.I. FLASH'G (PAINTED)
BUILT-UP ROOFING OVER 1/2" EXTR. PLYWD
26 GA. G.I. FLASHING
8" STEEL BEAM - SEE STRUCTURAL
15" STL CHANNEL (PAINTED)
26 GA. G.I. FLASHING (PAINTED) W/ HEMMED EDGE AS SHOWN.
1/2" EXTERIOR TYPE GYPSUM BD. ON 2 1/2" STL. STUDS AT 16" O.C.
8
TYPICAL CANOPY FASCIA 1 1/2" = 1'-0"
CANOPY AT
BUSINESS AREA STAFF/ OPERATIONS STAFF
CONT'S JT. SEALANT W/ NEOPRENE SLEEVE BACKUP
13
EXPANSION JOINT - SOUTH WALL
14
EXPANSION JOINT - SOUTH WALL 1 1/2" = 1'-0"
CRICKET OF BUILT-UP ROOFING OVER 2-2" RIGID INSULAT'N BOARDS
SEE AS ROOF PLAN FOR CRICKETS REQUIRED.
TRANSLUCENT INSULATING SKYLIGHT PRESSEALED ALUMINUM FRAME
CONTINUOUS JOINT SEALANT BETW. ALUM. FRAME & FLASHING
METAL "J" MOLDING
2'-1 1/2" ROUGH OPENING
16/8
CONC. FILL OVER METAL DECK
VINYL WALLCOVERING OVER 5/8" F.R. GYPSUM BOARD
15
CONTINUOUS SKYLIGHT SECTION
FIRE-RATED
DUCT
SEALANT
ALUM. LOUVER
8'-0" LOUVER
19
LOUVER JAMB 1 1/2" = 1'-0"
ALUM. LOUVER
DUCT - SEE MECH.
JT. SEALANT
ROOFING FELT BOND BREAK TYPICAL
20
MECH. LOUVER SILL 1 1/2" = 1'-0"
EXTEND GLASS FACING INTO SCUPPER
EXTEND ROOFING INTO SCUPPER
SCUPPER OF 1/8" PLATE WELDED IN PLACE & GROUND SMOOTH
21
SEE ALSO DET. 8/8
TYPICAL CANOPY SCUPPER SECTION 1 1/2" = 1'-0"
ALUM. FASCIA
STL C FASCIA
GALV. IRON FLASHING PAINTED TO MATCH STL. C FASCIA
22
CANOPY SCUPPER
CONTINUOUS JOINT SEALANT W/ NEOPRENE SLEEVE BACK-UP
METAL EXPANSION JOINT "W" SHAPE
26
EXP'N JT.
A 8

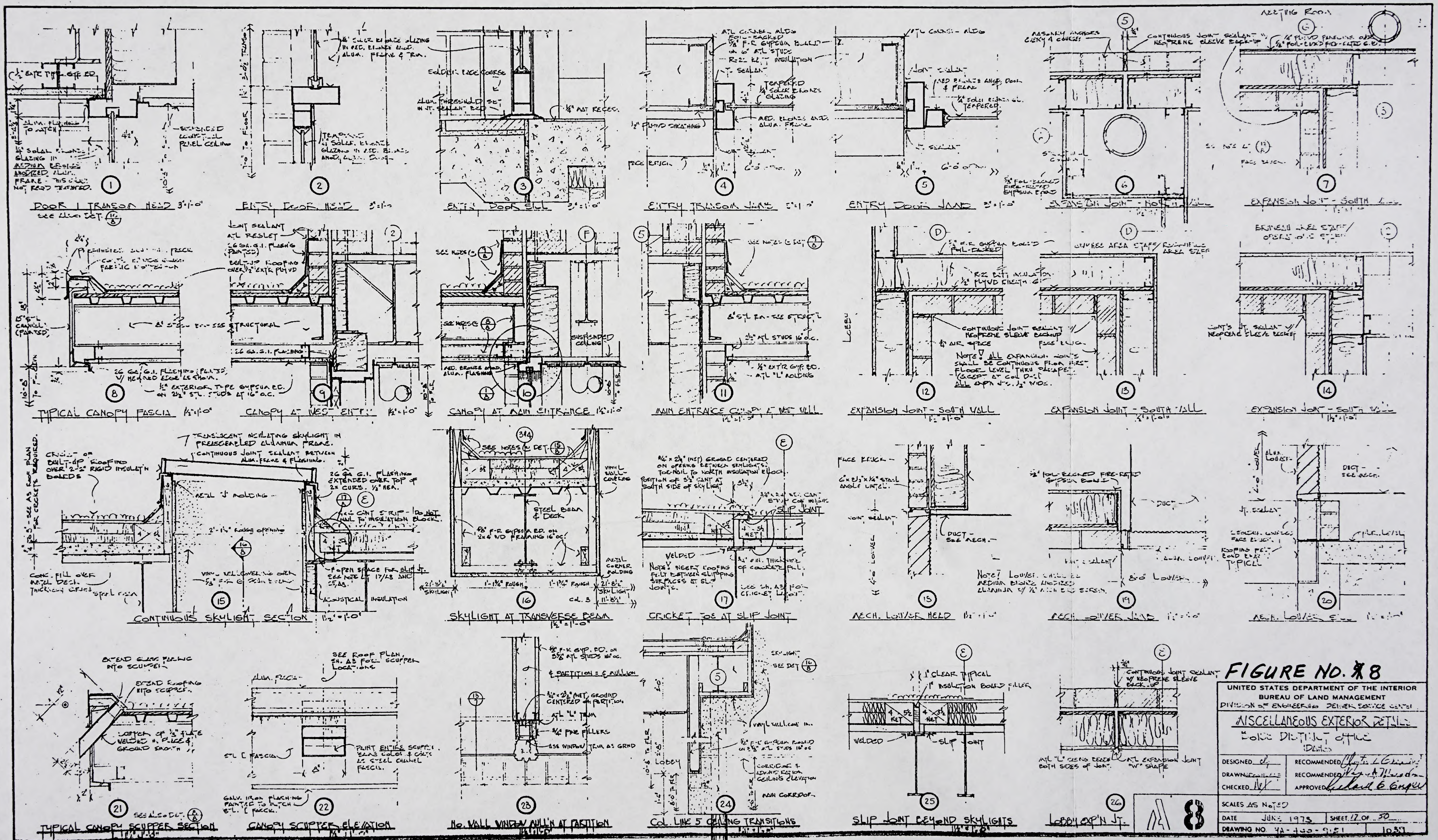
FIGURE NO. ~~7~~ 8

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

MISCELLANEOUS EXTERIOR DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED	RECOMMENDED Clayton L. Grimmius
DRAWN	RECOMMENDED Wayne A. Wilcox
CHECKED	APPROVED Richard E. Cooper

SCALES AS NOTED
DATE JUNE 1978 SHEET 17 OF 50
DRAWING NO. YA - 400 - 9151 1039



1 DOOR & TRANSOM HEAD 3"=1'-0" SEE ALUM. DET. 12/8
2 ENTRY DOOR HEAD 3"=1'-0"
3 ENTRY DOOR SILL 3"=1'-0"
4 ENTRY TRANSOM JAMB 3"=1'-0"
5 ENTRY DOOR JAMB 3"=1'-0"
6 EXPANSION JOINT - NORTH WALL
7 EXPANSION JOINT - SOUTH WALL
8 TYPICAL CANOPY FASCIA 1½"=1'-0"
9 CANOPY AT WEST ENTRY 1½"=1'-0"
10 CANOPY AT MAIN ENTRANCE 1½"=1'-0"
11 MAIN ENTRANCE CANOPY & WEST WALL 1½"=1'-0"
12 EXPANSION JOINT - SOUTH WALL 1½"=1'-0"
13 EXPANSION JOINT - SOUTH WALL 1½"=1'-0"
14 EXPANSION JOINT - SOUTH WALL 1½"=1'-0"
15 CONTINUOUS SKYLIGHT SECTION 1½"=1'-0"
16 SKYLIGHT AT TRANSVERSE BEAM 1½"=1'-0"
17 CRICKET TOE AT SLIP JOINT
18 MECH. LOUVER HEAD 1½"=1'-0"
19 MECH. LOUVER JAMB 1½"=1'-0"
20 MECH. LOUVER SILL 1½"=1'-0"
21 TYPICAL CANOPY SCUPPER SECTION
22 CANOPY SCUPPER ELEVATION
23 NO. WALL WINDOW MULL'N AT PARTITION
24 COL. LINE 5 CEILING TRANSITIONS
25 SLIP JOINT BEYOND SKYLIGHTS 1½"=1'-0"
26 LOBBY EXP'N JT.
NOTE: ALL EXPANSION JOINTS SHALL BE CONTINUOUS FROM FIRST FLOOR LEVEL THRU PARAPET EXCEPT AT COL D-13. ALL EXP'N JTS. ½" WIDE.
NOTE: LOUVER SHALL BE MEDIUM BRONZE ANODIZED ALUMINUM W/ ½" MESH BIRD SCREEN.
TRANSLUCENT INSULATING SKYLIGHT IN PRESSEALED ALUMINUM FRAME.
A8

FIGURE NO. 8

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

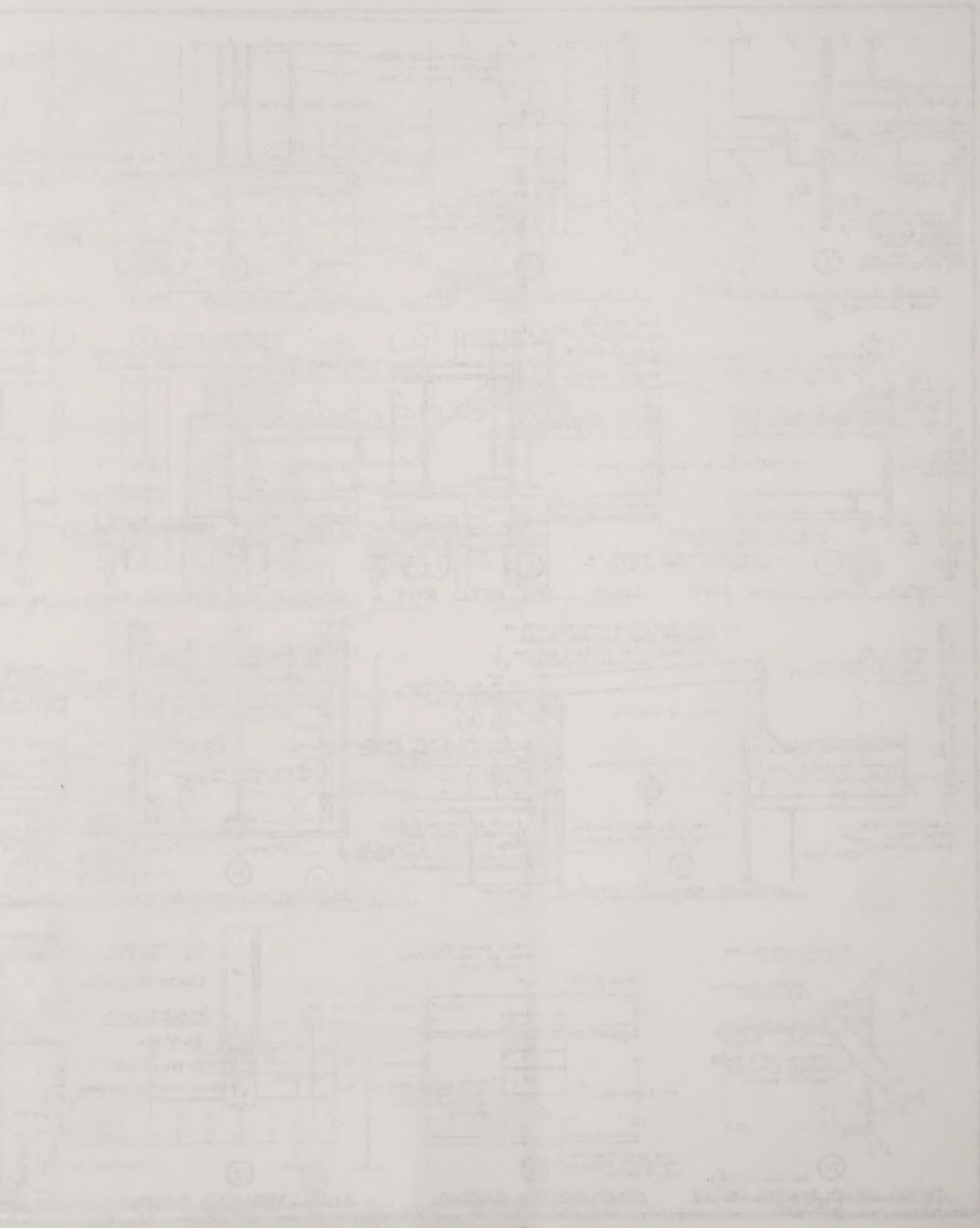
MISCELLANEOUS EXTERIOR DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED Clj
DRAWN [illegible]
CHECKED NK
RECOMMENDED Clayton L. [illegible]
RECOMMENDED [illegible]
APPROVED Richard G. Cooper

SCALES AS NOTED

DATE JUNE 1973
SHEET 17 OF 50

DRAWING NO. YA-[illegible]-9151
1033



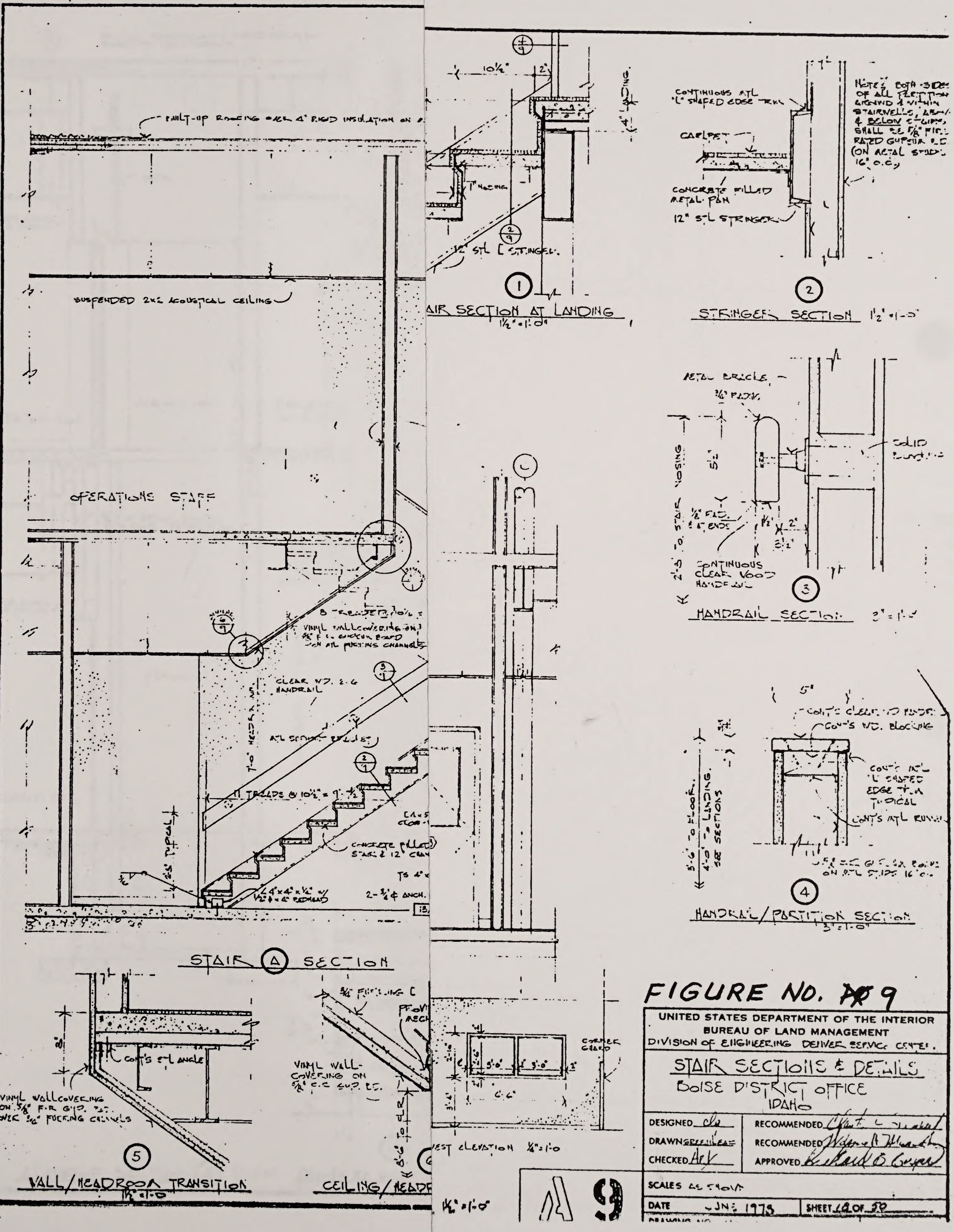
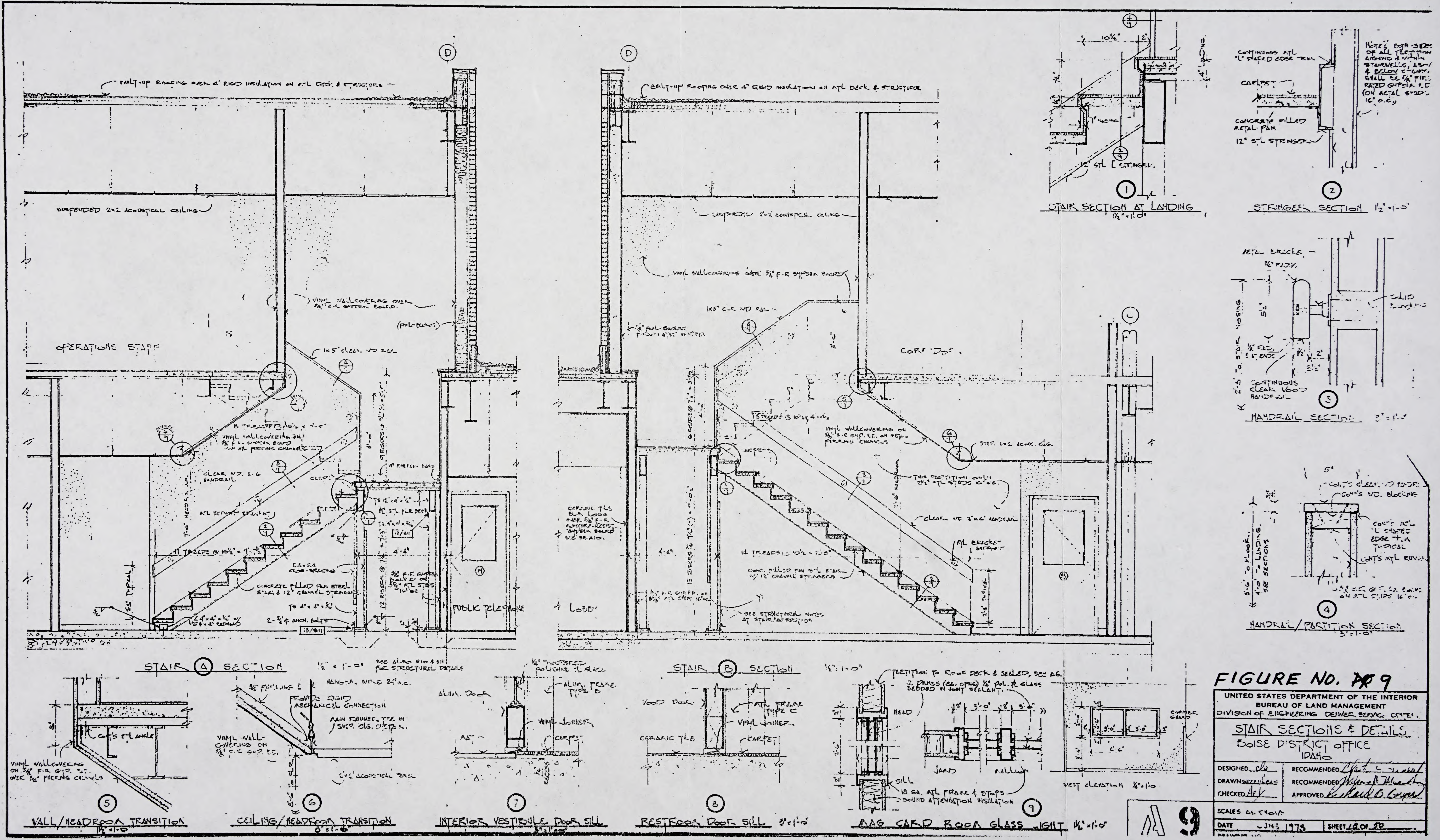

BUILT-UP ROOFING OVER 4" RIGID INSULATION ON
SUSPENDED 2x2 ACOUSTICAL CEILING
OPERATIONS STAFF
8 TREADS @ 10½"
VINYL WALLCOVERING ON 5/8" F.R. GYPSUM BOARD ON MTL FURRING CHANNELS
CLEAR WD. 2.6 HANDRAIL
7'-0" HEADROOM
MTL SUPPORT BRACKET
11 TREADS @ 10½" = 9'-7½"
2'-6" TYPICAL
CONCRETE FILLED STAIR & 12" CHAN
4"x4"x½" w/ ½"φ x 4" REDHEAD
2-¾"φ ANCH.
STAIR Ⓐ SECTION
10½"
2"
1" NOSING
4" LANDING
12" STL [STRINGER
①
STAIR SECTION AT LANDING
1½" = 1'-0"
CONTINUOUS MTL "L" SHAPED EDGE TRIM
CARPET
CONCRETE FILLED METAL PAN
12" STL STRINGER
NOTES: BOTH SIDES OF ALL PARTITIONS AROUND & WITHIN STAIRWELLS, ABOVE & BELOW STAIRS, SHALL BE 5/8" FIRE RATED GYPSUM BD (ON METAL STUDS 16" o.c.)
②
STRINGER SECTION 1½" = 1'-0"
METAL BRACKET
¾" RADIUS
½" RAD. @ ENDS
2'-6" TO STAIR NOSING
5¼"
1½"
2"
3½"
CONTINUOUS CLEAR WOOD HANDRAIL
SOLID BLOCKING
③
HANDRAIL SECTION 3" = 1'-0"
5"
CONT'S CLEAR WD FINISH
CONT'S WD. BLOCKING
CONT'S MTL "L" SHAPED EDGE TRIM TYPICAL
CONT'S MTL RUNNER
5/8" F.R. GYPSUM BOARD ON MTL STUDS 16" o.c.
3'-6" TO FLOOR, 4'-0" TO LANDING, SEE SECTIONS
④
HANDRAIL/PARTITION SECTION
3" = 1'-0"
CONT'S STL ANGLE
VINYL WALLCOVERING ON 5/8" F.R. GYP. BD. OVER ¾" FURRING CHANNELS
⑤
WALL/HEADROOM TRANSITION
1½" = 1'-0"
¾" FURRING C
VINYL WALL-COVERING ON 5/8" F.R. GYP. BD.
CEILING/HEADR
WEST ELEVATION ¼" = 1'-0"
CORNER GUARD
5'-0"
5'-0"
6'-6"
A 9

FIGURE NO. ~~PX~~ 9

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

STAIR SECTIONS & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cla
DRAWN green/leaf
CHECKED ArV
RECOMMENDED
RECOMMENDED
APPROVED Richard B. Cooper
SCALES AS SHOWN
DATE JUNE 1978
SHEET 19 OF 52



BUILT-UP ROOFING OVER 4" RIGID INSULATION ON MTL DECK & STRUCTURE
SUSPENDED 2x2 ACOUSTICAL CEILING
VINYL WALLCOVERING OVER 5/8" F.R. GYPSUM BOARD
OPERATIONS STAFF
1x5" CLEAR WD RAIL
CLEAR WD 2x6 HANDRAIL
11 TREADS @ 10½" =
CONCRETE FILLED PAN STEEL STAIR & 12" CHANNEL STRINGERS
2-¾"ф ANCH. BOLTS
13/S11
PUBLIC TELEPHONE
STAIR Ⓐ SECTION
½" = 1'-0"
SEE ALSO S10 & S11 FOR STRUCTURAL DETAILS
VINYL WALLCOVERING OVER 5/8" F.R. GYPSUM BOARD
1x5" C.C. WD RAIL
CORRIDOR
LOBBY
CERAMIC TILE
14 TREADS @ 10½" =
CONC. FILLED PAN STL STAIR W/ 12" CHANNEL STRINGERS
CLEAR WD 2x6 HANDRAIL
MTL BRACKET SUPPORT
SEE STRUCTURAL NOTES AT STAIR 'A' SECTION
STAIR Ⓑ SECTION
½" : 1-0"
10½"
2"
7" NOSING
12" STL [STRINGER
①
STAIR SECTION AT LANDING
1½" = 1'-0"
CONTINUOUS MTL "L" SHAPED EDGE TRIM
CARPET
CONCRETE FILLED METAL PAN
12" STL STRINGER
NOTE: BOTH SIDES OF ALL PARTITION AROUND & WITHIN STAIRWELLS, ABOVE & BELOW STAIRS, SHALL BE 5/8" FIRE RATED GYPSUM B.D. (ON METAL STUDS 16" O.C.)
②
STRINGER SECTION 1½" = 1'-0"
METAL BRACKET
CONTINUOUS CLEAR WOOD HANDRAIL
③
HANDRAIL SECTION 3" = 1'-0"
CONT'S CLEAR WD RAIL
CONT'S WD. BLOCKING
CONT'S MTL "L" SHAPED EDGE TRIM TYPICAL
④
HANDRAIL/PARTITION SECTION 3" = 1'-0"
VINYL WALLCOVERING ON 5/8" F.R. GYP. BD. OVER ½" FURRING CHANNELS
CONT'S STL ANGLE
⑤
WALL/HEADROOM TRANSITION
1½" = 1'-0"
¾" FURRING [
PROVIDE RIGID MECHANICAL CONNECTION
HANGER WIRE 24" O.C.
MAIN RUNNER TEE IN SUSP. CLG. SYSTEM
VINYL WALLCOVERING ON 5/8" F.R. GYP. BD.
2'x2' ACOUSTICAL PANEL
⑥
CEILING/HEADROOM TRANSITION
3" = 1'-0"
¼" THRESHOLD POLISHED ALUM.
ALUM. DOOR
ALUM. FRAME TYPE B
VINYL JOINER
CARPET
⑦
INTERIOR VESTIBULE DOOR SILL
3" = 1'-0"
WOOD DOOR
MTL FRAME TYPE C
VINYL JOINER
CERAMIC TILE
CARPET
⑧
RESTROOM DOOR SILL 3" = 1'-0"
PARTITION TO ROOF DECK & SEALED, SEE A6.
2 PANES (EA. OPNG) ¼" POL. PL GLASS BEDDED IN JOINT SEALANT.
HEAD
SILL
JAMB
MULLION
18 GA. MTL FRAME & STOPS
SOUND ATTENUATION INSULATION
WEST ELEVATION ¼" = 1'-0"
CORNER GUARD
⑨
MAG CARD ROOM GLASS LIGHT 1½" = 1'-0"
A 9

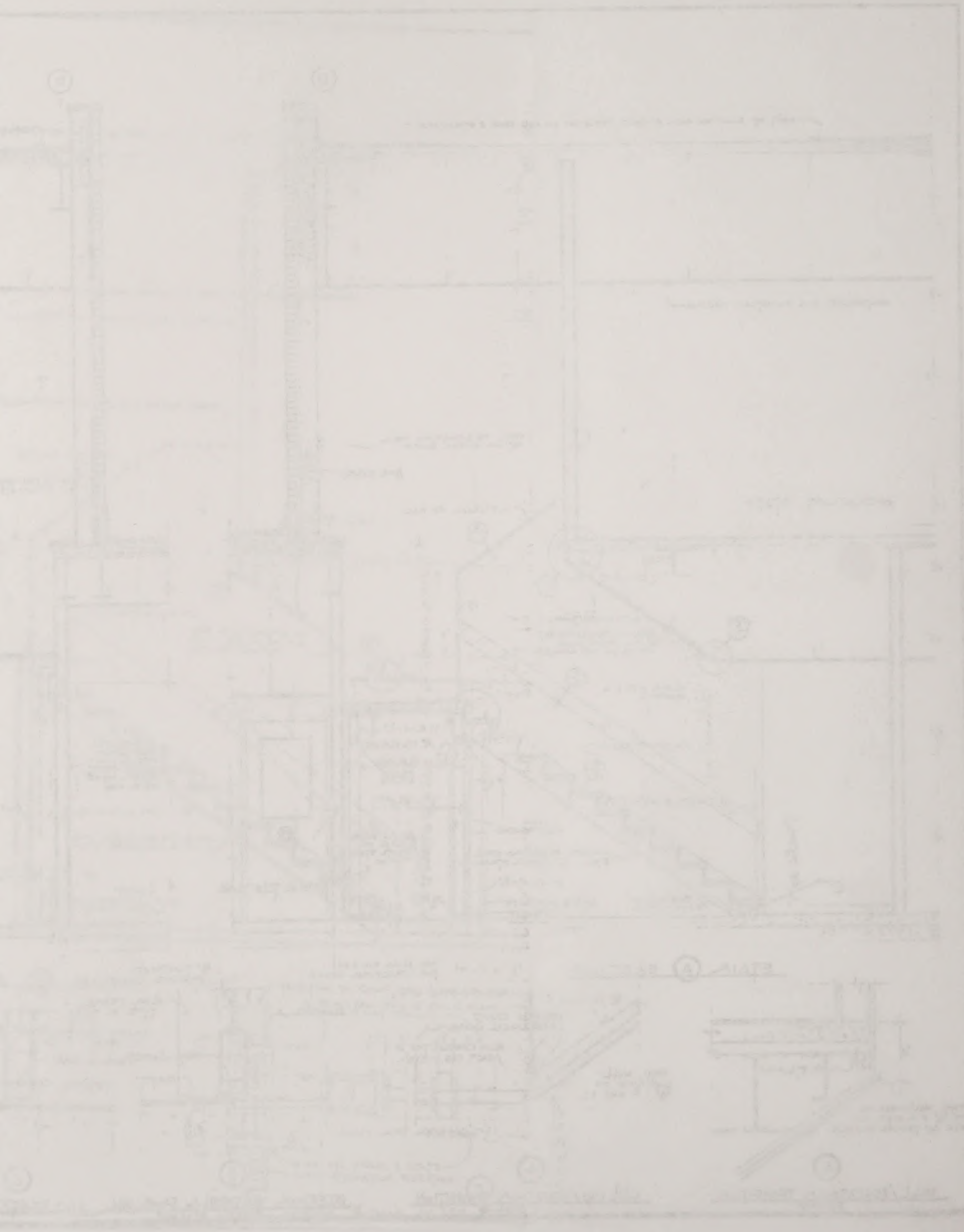
FIGURE NO. 9

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER.

STAIR SECTIONS & DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED Cle
DRAWN
CHECKED Ark
RECOMMENDED
RECOMMENDED
APPROVED Richard O. Cooper

SCALES AS SHOWN
DATE JUNE 1978
SHEET 40 OF 52


STAIR 4 SECTION

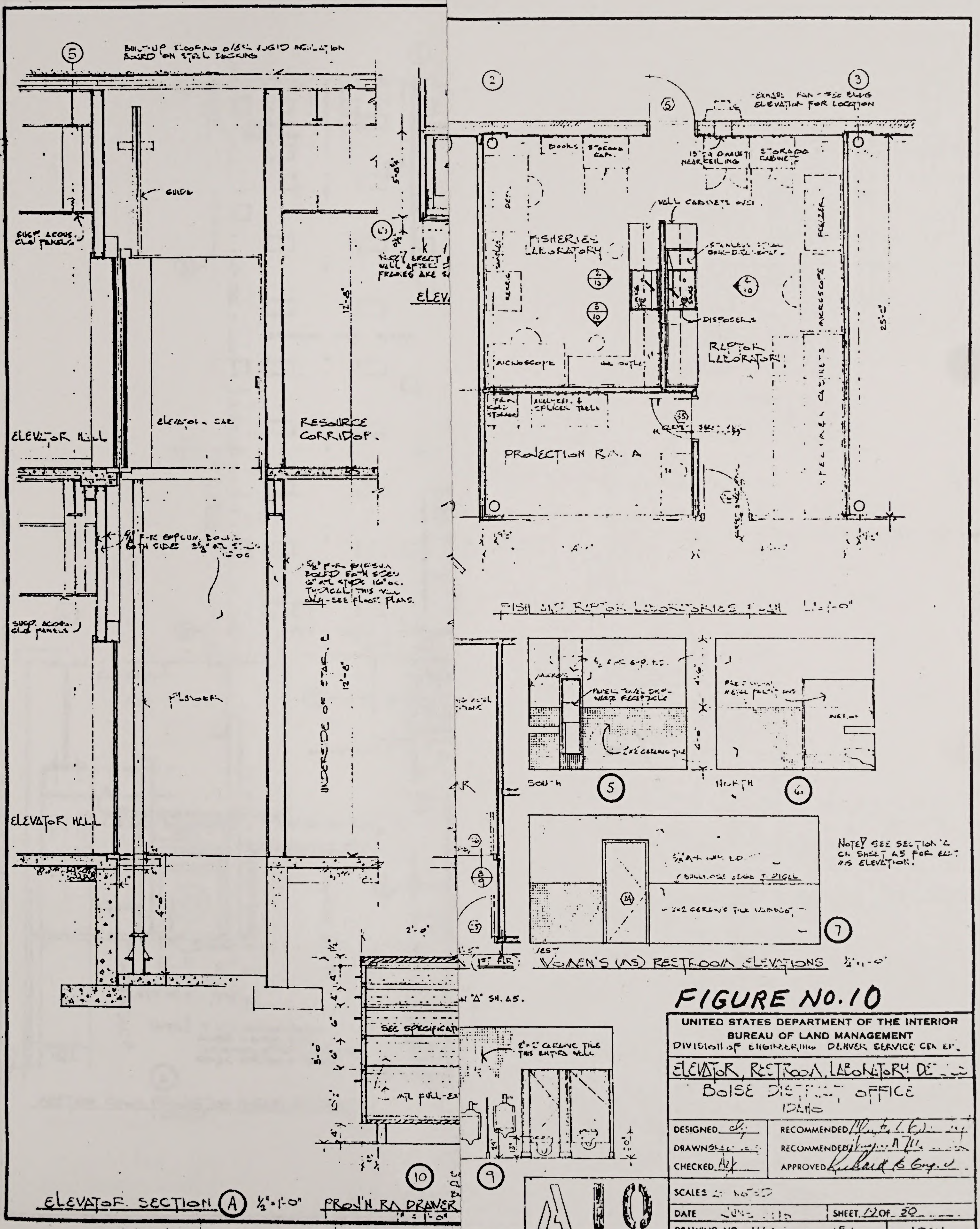

BUILT-UP ROOFING OVER RIGID INSULATION BOARD ON STEEL DECKING
5
GUIDE
SUSP. ACOUS. CLG PANELS
ELEVATOR HALL
ELEVATOR CAR
RESOURCE CORRIDOR
5/8" F-R GYPSUM BOARD BOTH SIDES 2 1/2" MTL STUDS 16" OC
5/8" F-R GYPSUM BOARD BOTH SIDES 6" MTL STUDS 16" OC. TYPICAL THIS WALL ONLY - SEE FLOOR PLANS.
UNDERSIDE OF STAIR
12'-8"
FLOOR
ELEVATOR HALL
4'-0"
2'-0"
ELEVATOR SECTION A 1/2" = 1'-0"
PROJ'N RM DRAWER 1" = 1'-0"
SEE SPECIFICATIONS
MTL FULL-EXT
2
3
EXHAUST FAN - SEE BLDG ELEVATION FOR LOCATION
BOOKS
STORAGE CAB.
15" SQ EXHAUST NEAR CEILING
STORAGE CABINET
WALL CABINETS OVER
STAINLESS STEEL SINK-DISPOSER
FREEZER
FISHERIES LABORATORY
DISPOSERS
MICROSCOPE
RAPTOR LABORATORY
MICROSCOPE
SPECIMEN CABINETS
PROJECTION RM. A
25'-2"
FISH AND RAPTOR LABORATORIES PLAN 1/4" = 1'-0"
SOUTH
5
NORTH
6
CERAMIC TILE
NOTE: SEE SECTION 'C' ON SHEET A5 FOR EAST WALL ELEVATION.
7
WOMEN'S (MS) RESTROOM ELEVATIONS 1/4" = 1'-0"
2"x2" CERAMIC TILE THIS ENTIRE WALL
10
9
A 10

FIGURE NO. 10

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

ELEVATOR, RESTROOM, LABORATORY DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED [illegible]
DRAWN [illegible]
CHECKED [illegible]
RECOMMENDED [illegible]
RECOMMENDED [illegible]
APPROVED [illegible]

SCALES AS NOTED
DATE [illegible]
SHEET 12 OF 30
DRAWING NO. [illegible] 10[illegible]

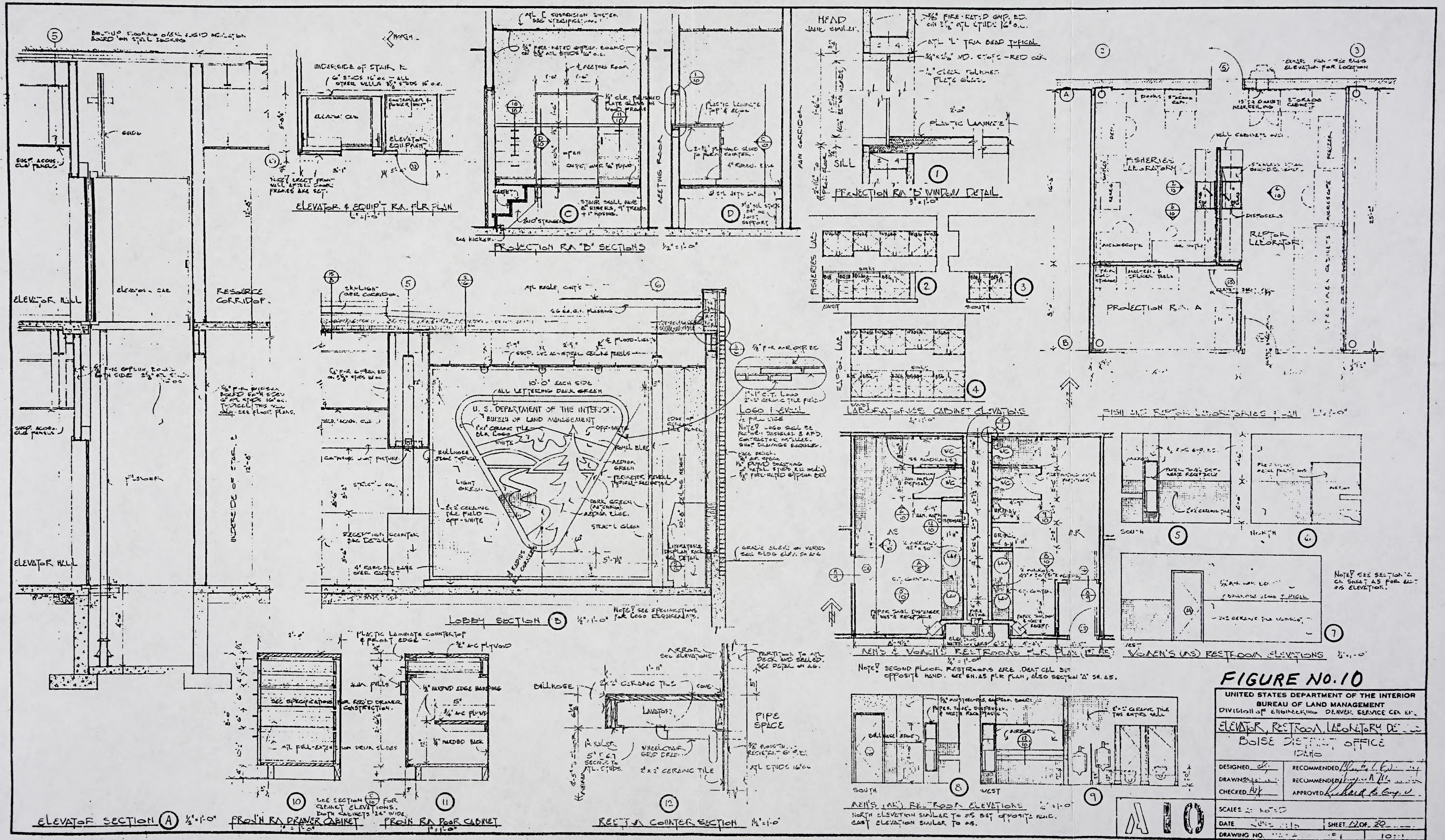
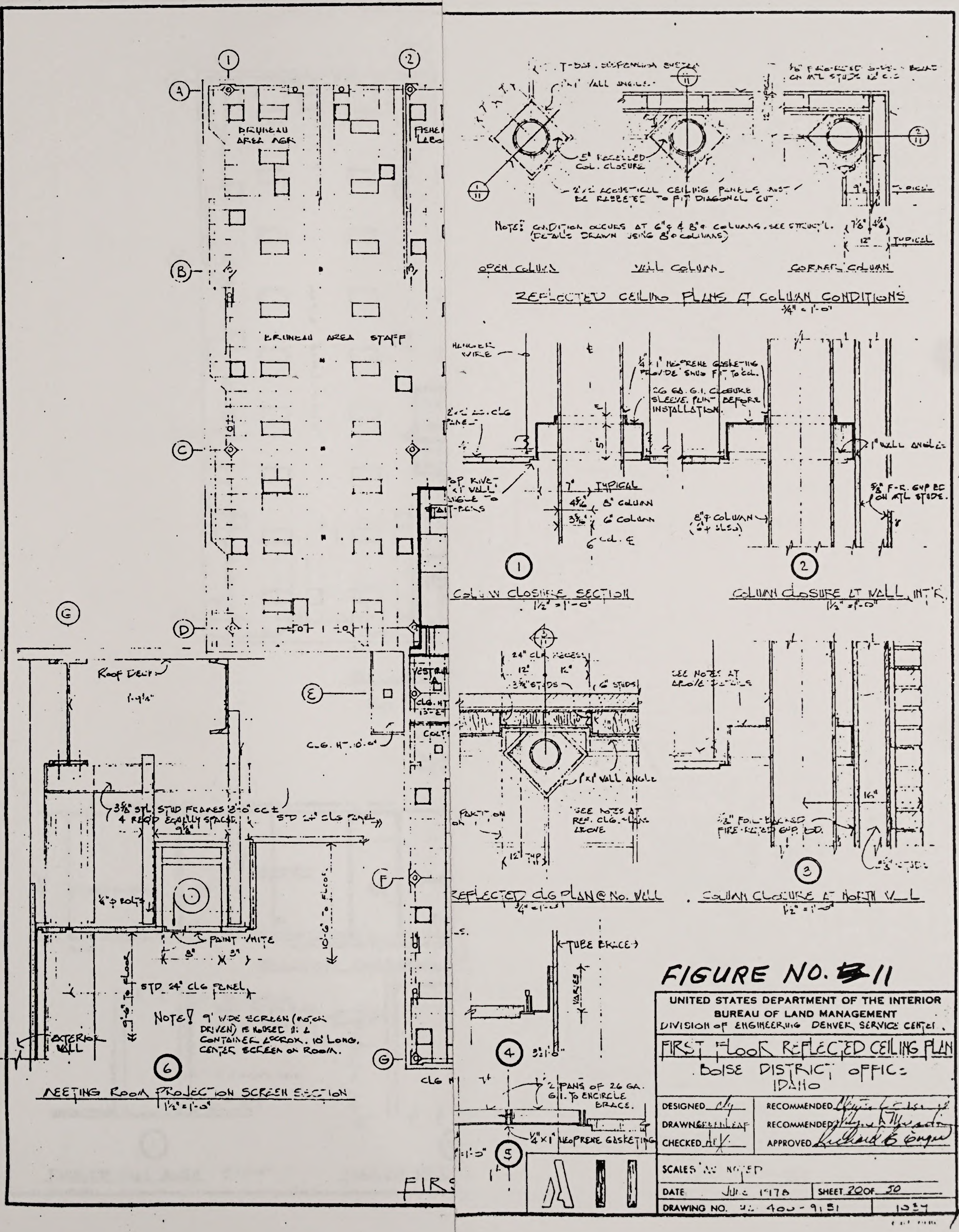

ELEVATOR SECTION (A) 1/4"=1'-0"
ELEVATOR HALL
RESOURCE CORRIDOR
ELEVATOR & EQUIP'T RM. FLR PLAN 1/4"=1'-0"
ELEVATOR CAR
ELEVATOR EQUIPMENT
NORTH
PROJECTION RM "B" SECTIONS 1/2"=1'-0"
MEETING ROOM
PROJECTION RM "B" WINDOW DETAIL 3"=1'-0"
HEAD
SILL
PLASTIC LAMINATE
LOBBY SECTION (B) 1/2"=1'-0"
10'-0" EACH SIDE ALL LETTERING DARK GREEN
U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
NOTE: SEE SPECIFICATIONS FOR LOGO REQUIREMENTS.
LOGO DETAIL
FISHERIES LAB
EAST
SOUTH
LABORATORIES CABINET ELEVATIONS 1/4"=1'-0"
FISHERIES LABORATORY
RAPTOR LABORATORY
PROJECTION RM. A
FISH AND RAPTOR LABORATORIES PLAN 1/4"=1'-0"
MEN'S & WOMEN'S RESTROOMS FLR PLAN (1ST FLR) 1/4"=1'-0"
NOTE: SECOND FLOOR RESTROOMS ARE IDENTICAL BUT OPPOSITE HAND. SEE SH. A5 FLR PLAN, ALSO SECTION "A" SH. A5.
WOMEN'S (WS) RESTROOM ELEVATIONS 1/4"=1'-0"
NOTE: SEE SECTION C ON SHEET A5 FOR EAST WS ELEVATION.
MEN'S (MR) RESTROOM ELEVATIONS 1/4"=1'-0"
NORTH ELEVATION SIMILAR TO WS BUT OPPOSITE HAND.
EAST ELEVATION SIMILAR TO WS.
PROJ'N RM DRAWER CABINET 1"=1'-0"
PROJ'N RM DOOR CABINET 1"=1'-0"
SEE SECTION C/10 FOR CABINET ELEVATIONS. BOTH CABINETS 24" WIDE.
MEETING RM COUNTER SECTION 1 1/2"=1'-0"
LAVATORY
PIPE SPACE
A10

FIGURE NO.10

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

ELEVATOR, RESTROOM, LABORATORY DE[illegible]
BOISE DISTRICT OFFICE
IDAHO

DESIGNED [illegible]
DRAWN [illegible]
CHECKED AZK
RECOMMENDED [illegible]
RECOMMENDED [illegible]
APPROVED Richard B. Gray
SCALES AS NOTED
DATE [illegible]
SHEET 12 OF 30
DRAWING NO. [illegible] 10[illegible]



BRUNEAU AREA MGR
FISHER LEG
BRUNEAU AREA STAFF
VESTIBULE
CLG. HT. 10'-0"
STD 24" CLG PANEL
T-BAR SUSPENSION SYSTEM
1"x1" WALL ANGLE
5" RECESSED COL. CLOSURE
2'x2' ACOUSTICAL CEILING PANELS MUST BE RABBETED TO FIT DIAGONAL CUT.
5/8" FIRE-RATED GYP. BOARD ON MTL STUDS 24" O.C.
NOTE: CONDITION OCCURS AT 6"ø & 8"ø COLUMNS. SEE STRUCT'L. (DETAILS DRAWN USING 8"ø COLUMNS)
TYPICAL
OPEN COLUMN
WALL COLUMN
CORNER COLUMN
REFLECTED CEILING PLANS AT COLUMN CONDITIONS
1/4" = 1'-0"
HANGER WIRE
1/4" x 1" NEOPRENE GASKETING PROVIDE SNUG FIT TO COL.
26 GA. G.I. CLOSURE SLEEVE. PAINT BEFORE INSTALLATION.
2'x2' AC. CLG PANEL
POP RIVET 1"x1" WALL ANGLE TO STUDS
8" COLUMN
6" COLUMN
COL. ℄
1" WALL ANGLE
5/8" F.R. GYP BD ON MTL STUDS
8"ø COLUMN (6"ø ALSO)
COLUMN CLOSURE SECTION
1 1/2" = 1'-0"
COLUMN CLOSURE AT WALL, INT'R.
1 1/2" = 1'-0"
24" CLR ACCESS
3 5/8" STUDS
6" STUDS
SEE NOTES AT ABOVE DETAILS
PARTITION
SEE NOTES AT REF. CLG. PLAN ABOVE
1/2" FOIL-BACKED FIRE-RATED GYP. BD.
REFLECTED CLG PLAN @ NO. WALL
1/4" = 1'-0"
COLUMN CLOSURE AT NORTH WALL
1 1/2" = 1'-0"
TUBE BRACE
VARIES
2 PANS OF 26 GA. G.I. TO ENCIRCLE BRACE.
1/4" x 1" NEOPRENE GASKETING
ROOF DECK
3 5/8" STL STUD FRAMES 2'-0" CC± 4 REQ'D EQUALLY SPACED.
STD 24" CLG PANEL
1/4"ø BOLTS
PAINT WHITE
EXTERIOR WALL
NOTE: 9' WIDE SCREEN (MOTOR DRIVEN) IS HOUSED IN A CONTAINER APPROX. 10' LONG. CENTER SCREEN ON ROOM.
MEETING ROOM PROJECTION SCREEN SECTION
1 1/2" = 1'-0"
FIRST

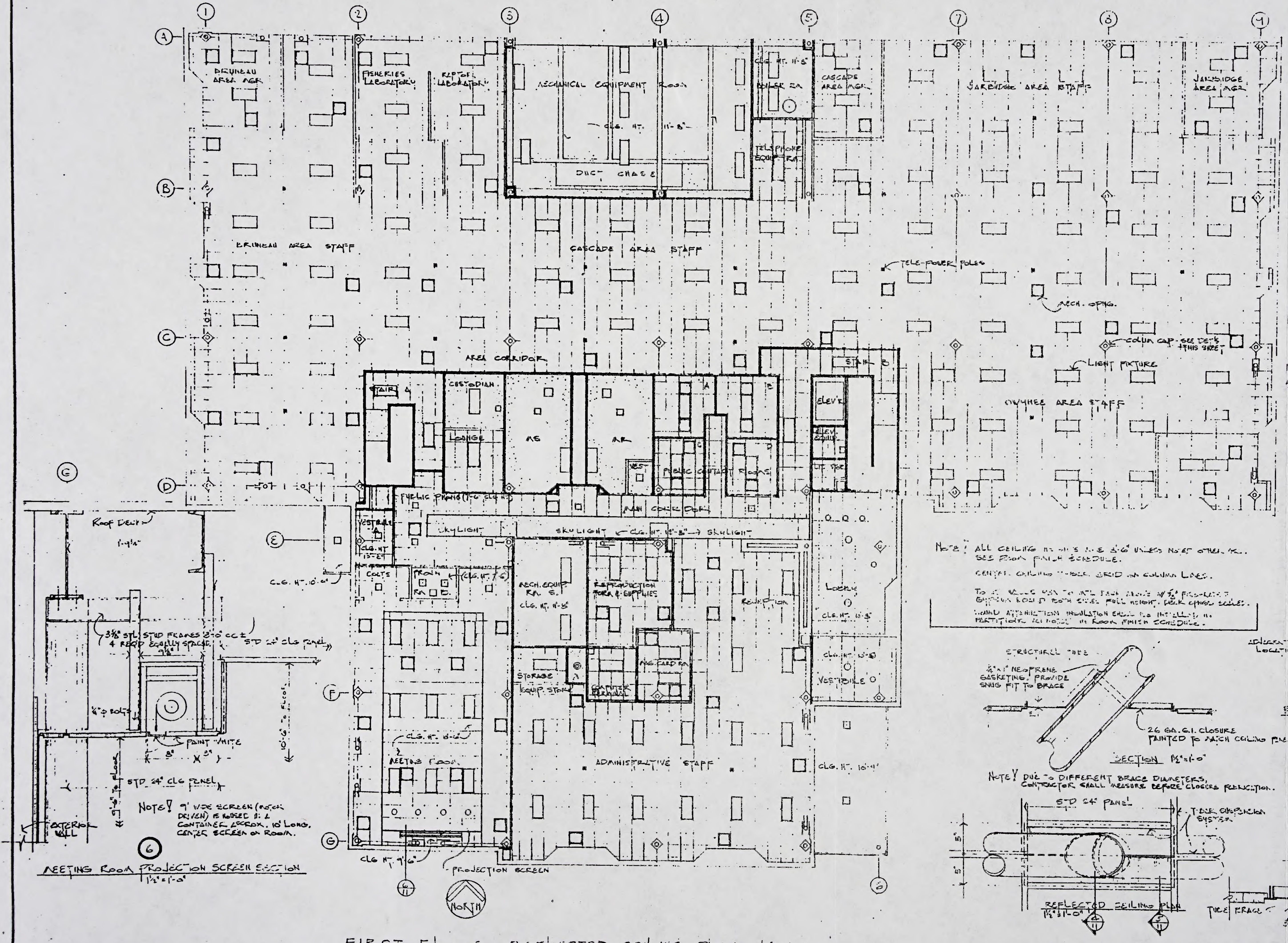
FIGURE NO. 11

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

FIRST FLOOR REFLECTED CEILING PLAN
BOISE DISTRICT OFFICE
IDAHO

DESIGNED CLY
DRAWN GREENLEAF
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard B. Conger

SCALES AS NOTED
DATE JUNE 1978
SHEET 20 OF 50
DRAWING NO. 400-9151
1037



FIRST FLOOR REFLECTED CEILING PLAN

1/8" = 1'-0"

MEETING ROOM PROJECTION SCREEN SECTION

1 1/2" = 1'-0"

NOTE! 9' WIDE SCREEN (MOTOR DRIVEN) IS HOUSED IN A CONTAINER APPROX. 10' LONG. CENTER SCREEN ON ROOM.

NOTE: ALL CEILING HEIGHTS ARE 8'-6" UNLESS NOTED OTHERWISE. SEE ROOM FINISH SCHEDULE.

CENTER CEILING T-BAR GRID ON COLUMN LINES.

TO ... WALLS ... TO ... ABOVE W/ 5/8" FIRE-RATED GYPSUM BOARD BOTH SIDES FULL HEIGHT. ... SCHEDULE.

SOUND ATTENUATION INSULATION SHALL BE INSTALLED IN PARTITIONS ... IN ROOM FINISH SCHEDULE.

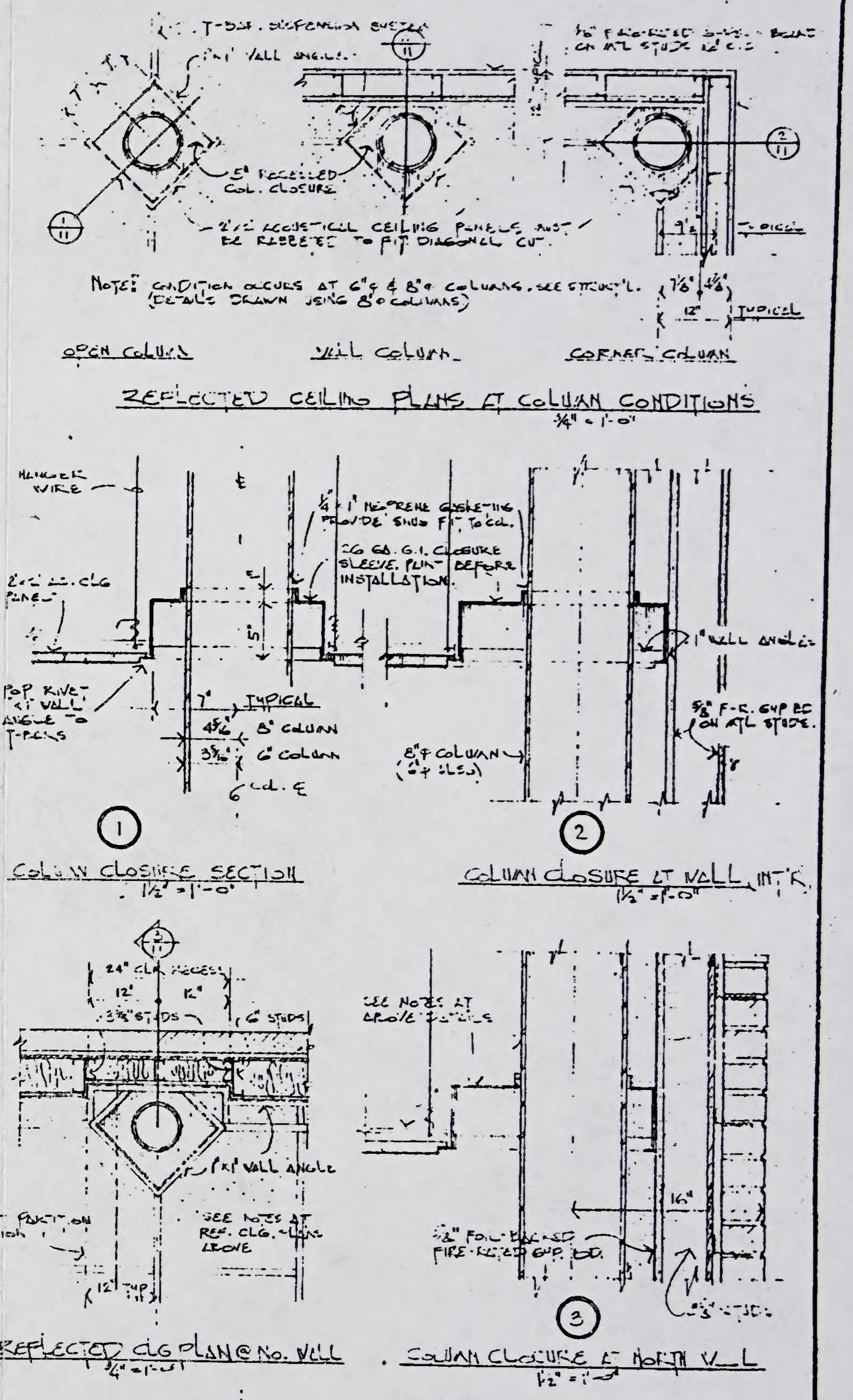
SECTION 1 1/2" = 1'-0"

NOTE! DUE TO DIFFERENT BRACE DIAMETERS, CONTRACTOR SHALL MEASURE BEFORE CLOSURE FABRICATION.

REFLECTED CEILING PLAN 1 1/2" = 1'-0"

CEILING PENETRATION OF LATERAL BRACING

SCALES AS NOTED


T-BAR SUSPENSION SYSTEM
1"×1" WALL ANGLE
5" RECESSED COL. CLOSURE
2'×2' ACOUSTICAL CEILING PANELS MUST BE REBATED TO FIT DIAGONAL CUT.
5/8" FIRE-RATED GYPSUM BOARD ON MTL STUDS 16" O.C.
1/11
2/11
TYPICAL
7 1/2"
4 1/2"
12"
TYPICAL
HANGER WIRE
2'×2' AC. CLG PANEL
POP RIVET AT WALL ANGLE TO T-BARS
1/4"×1" NEOPRENE GASKETING PROVIDE SNUG FIT TO COL.
26 GA. G.I. CLOSURE SLEEVE. PAINT BEFORE INSTALLATION.
7" TYPICAL
4 5/8" 8" COLUMN
3 5/8" 6" COLUMN
COL. ℄
8" ⌀ COLUMN (6" ⌀ SIM.)
1" WALL ANGLE
5/8" F-R. GYP BD ON MTL STUDS.
1
2
3/11
24" CLR. ACCESS
12"
12"
3 5/8" STUDS
6" STUDS
1"×1" WALL ANGLE
ADJACENT PARTITION LOCATION
SEE NOTES AT REF. CLG. PLANS ABOVE
12" TYP.
SEE NOTES AT ABOVE DETAILS
16"
1/2" FOIL-BACKED FIRE-RATED GYP. BD.
3 5/8" STUDS
3

Note: CONDITION OCCURS AT 6"⌀ & 8"⌀ COLUMNS. SEE STRUCT'L. (DETAILS DRAWN USING 8"⌀ COLUMNS)

OPEN COLUMN

WALL COLUMN

CORNER COLUMN

REFLECTED CEILING PLANS AT COLUMN CONDITIONS

3/4" = 1'-0"

COLUMN CLOSURE SECTION

1 1/2" = 1'-0"

COLUMN CLOSURE AT WALL INT'R.

1 1/2" = 1'-0"

REFLECTED CLG PLAN @ No. WALL

3/4" = 1'-0"

COLUMN CLOSURE AT NORTH WALL

1 1/2" = 1'-0"

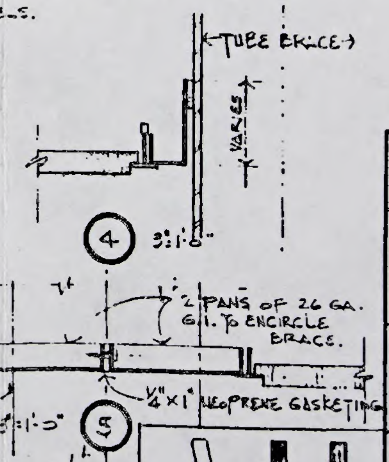

TUBE BRACE
VARIES
4
3" = 1'-0"
2 PANS OF 26 GA. G.I. TO ENCIRCLE BRACE.
TUBE BRACE
1/4"×1" NEOPRENE GASKETING
3" = 1'-0"
5

FIGURE NO. 11

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

FIRST FLOOR REFLECTED CEILING PLAN
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cly
DRAWN GREENLEAF
CHECKED D.K.
RECOMMENDED
RECOMMENDED
APPROVED Richard B. Grigus

SCALES AS NOTED
DATE JUNE 1978
SHEET 20 OF 50
DRAWING NO. ... 400-9151
1034

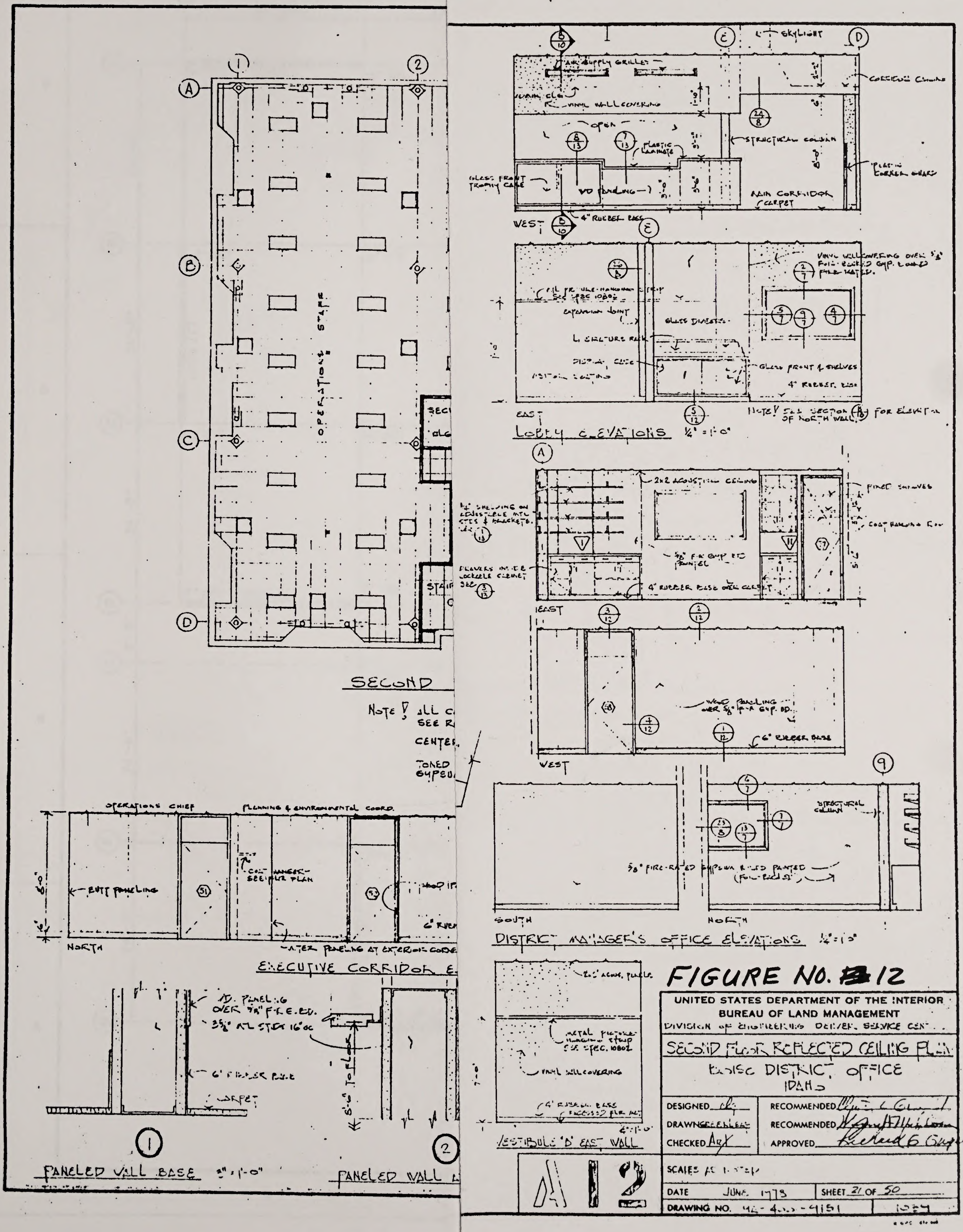


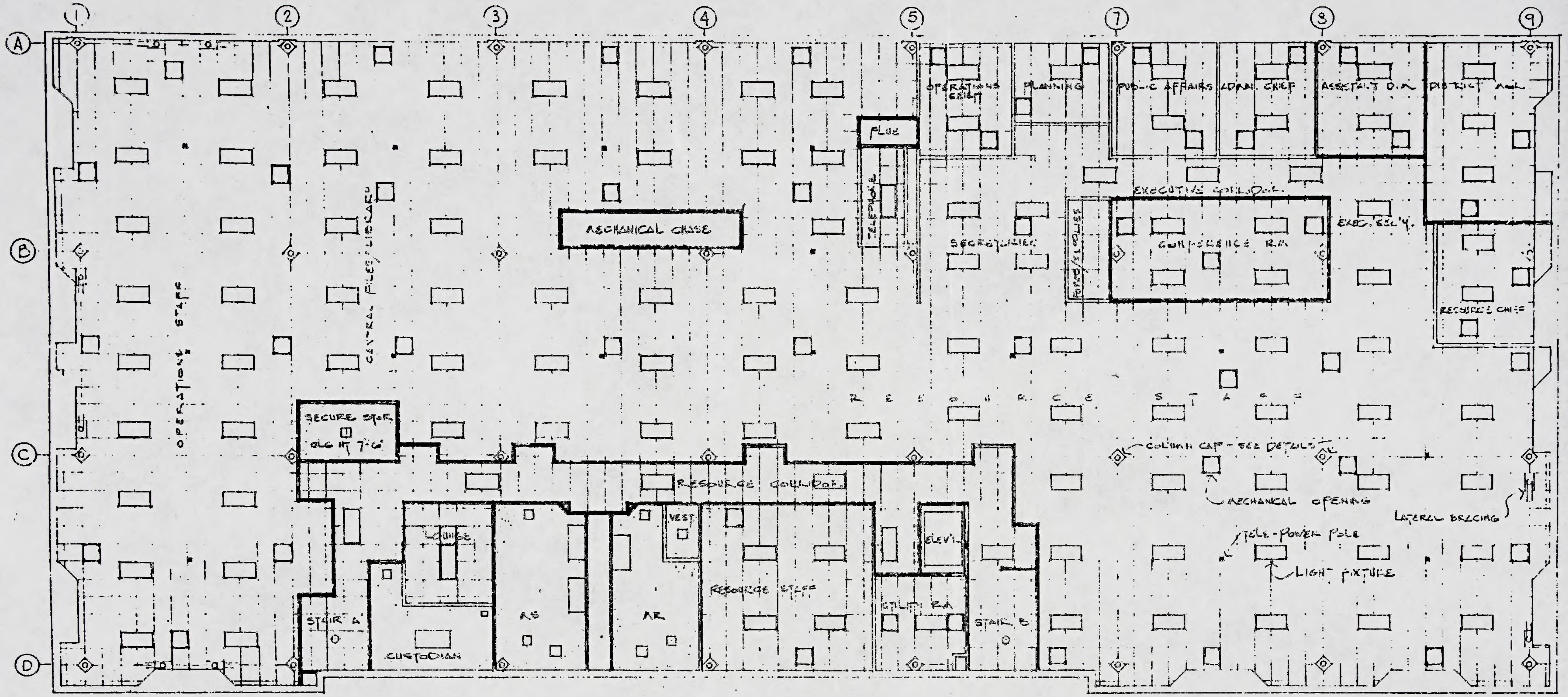
FIGURE NO. 12

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

SECOND FLOOR REFLECTED CEILING PLAN

BOISE DISTRICT OFFICE
IDAHO

DESIGNED	RECOMMENDED
DRAWN	RECOMMENDED
CHECKED	APPROVED Richard G. Guyer
SCALES AS NOTED	
DATE JUNE 1978	SHEET 21 OF 50
DRAWING NO. 4A-400-9151	1024



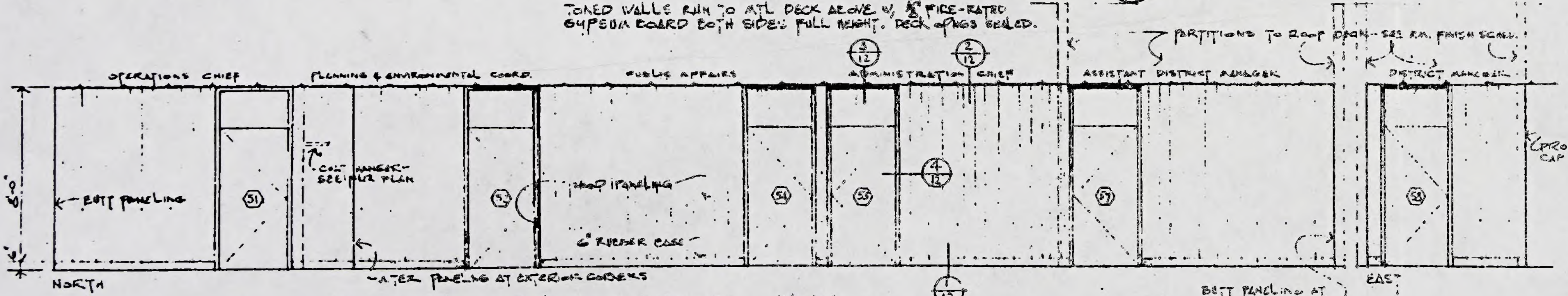
SECOND FLOOR REFLECTED CEILING PLAN 1/8" = 1'-0"

NOTE: ALL CEILING HEIGHTS ARE 8'-0" UNLESS NOTED OTHERWISE. SEE ROOM FINISH SCHEDULE.

CENTER CEILING T-BAR GRID ON COLUMN LINES.

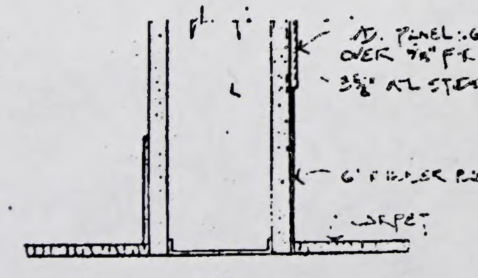
TONED WALLS RUN TO MTL DECK ABOVE W/ 5/8" FIRE-RATED GYPSUM BOARD BOTH SIDES FULL HEIGHT. DECK OPNGS SEALED.

NORTH

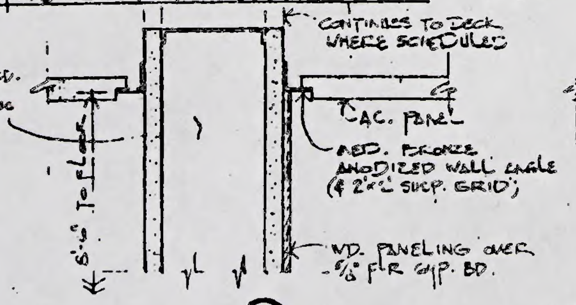


OPERATIONS CHIEF
PLANNING & ENVIRONMENTAL COORD.
PUBLIC AFFAIRS
ADMINISTRATION CHIEF
ASSISTANT DISTRICT MANAGER
DISTRICT MANAGER
PARTITIONS TO ROOF DECK - SEE RM. FINISH SCHED.
3/12
2/12
4/12
1/12
BUTT PANELING
COAT HANGER - SEE FLR PLAN
WOOD PANELING
6" RUBBER BASE
MITER PANELING AT EXTERIOR CORNERS
BUTT PANELING AT INTERIOR CORNERS
PROVIDE CAP MOLDING
51
52
54
55
57
58
8'-0"
NORTH
EAST

EXECUTIVE CORRIDOR ELEVATIONS 1/4" = 1'-0"

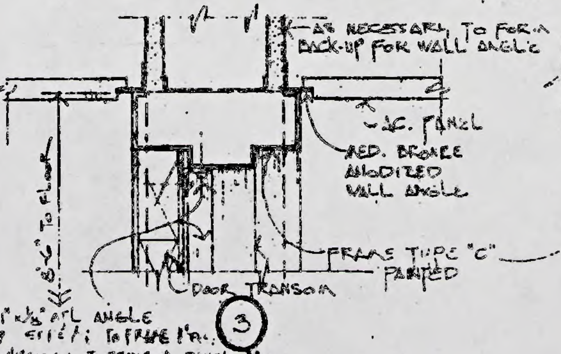


① PANELED WALL BASE 3" = 1'-0"



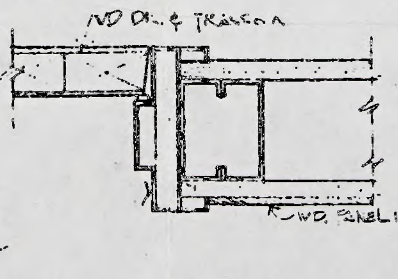
CONTINUES TO DECK WHERE SCHEDULED
AC. PANEL
MED. BRONZE ANODIZED WALL ANGLE (& 2'x2' SUSP. GRID)
WD. PANELING OVER 5/8" F.R. GYP. BD.
8'-0" TO FLOOR

② PANELED WALL AT CEILING 3" = 1'-0"

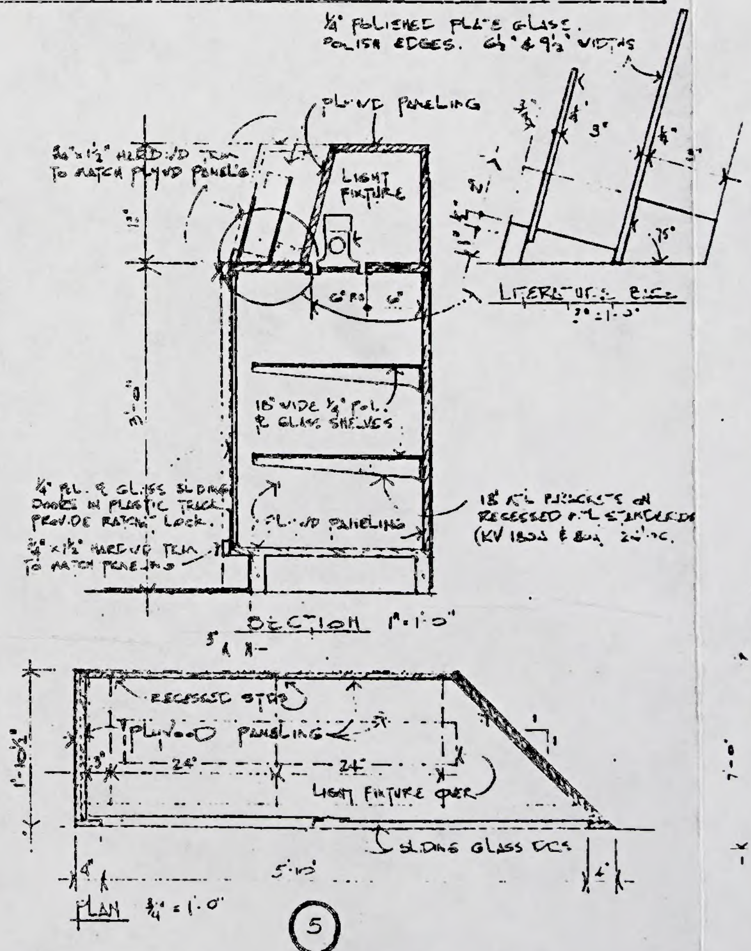


1"x1"x1/8" MTL ANGLE S.P. STITCH TO FRAME 1" O.C. #10 x 3/4" SCREW TO TRANSOM PANEL 3" O.C.

③ DOOR TRANSOM HEAD 3" = 1'-0"

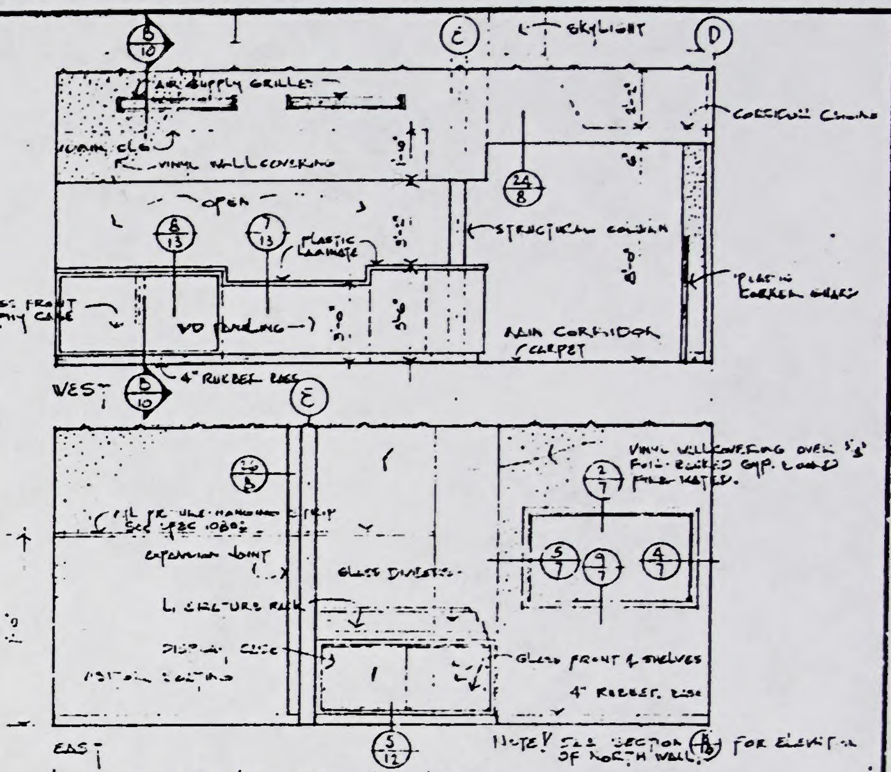


④ PANELED WALL @ DOOR JAMB 3" = 1'-0"



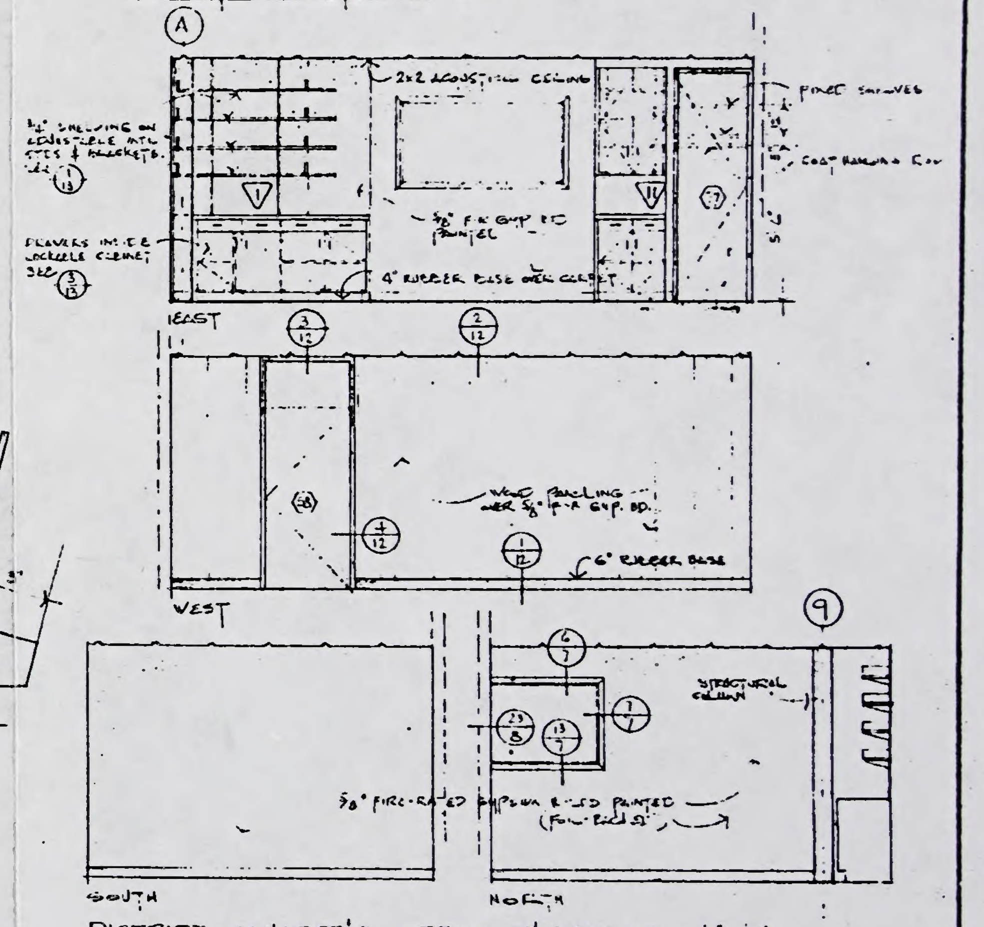
1/4" POLISHED PLATE GLASS. POLISH EDGES. 6 1/2" & 9 1/2" WIDTHS
PLYWD PANELING
3/4"x1 1/2" HARDWD TRIM TO MATCH PLYWD PANELS
LIGHT FIXTURE
6" 6"
3"
75°
LITERATURE RACK 3" = 1'-0"
18" WIDE 1/4" POL. PL. GLASS SHELVES
1/4" POL. PL. GLASS SLIDING DOORS IN PLASTIC TRACK. PROVIDE RATCHET LOCK.
3/4"x1 1/2" HARDWD TRIM TO MATCH PANELING
PLYWD PANELING
18" MTL BRACKETS ON RECESSED MTL STANDARDS (KV 180 & 80) 24" OC.
SECTION 1" = 1'-0"
RECESSED STDS
PLYWOOD PANELING
24"
24"
3"
LIGHT FIXTURE OVER
SLIDING GLASS DRS
1'-10 1/2"
5'-10"
4"
4"
PLAN 3/4" = 1'-0"

⑤ LOBBY LITERATURE RACK/DISPLAY CABINET



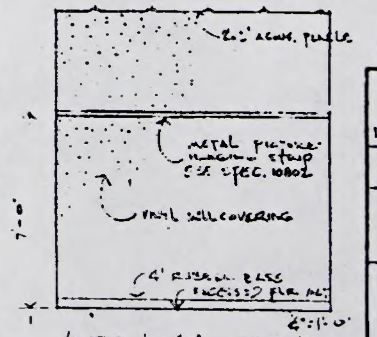
NOTE: SEE SECTION B/10 FOR ELEVATION OF NORTH WALL.

LOBBY ELEVATIONS 1/4" = 1'-0"



A
2x2 ACOUSTICAL CEILING
FIXED SHELVES
COAT HANGING ROD
3/4" SHELVING ON ADJUSTABLE MTL STDS & BRACKETS. SEE 1/13
DRAWERS INSIDE LOCKABLE CABINET SEE 3/13
5/8" F.R. GYP. BD. PAINTED
4" RUBBER BASE OVER CARPET
EAST
3/12
2/12
4/12
1/12
58
WOOD PANELING OVER 5/8" F.R. GYP. BD.
6" RUBBER BASE
WEST
9
6/7
25/8
13/7
1/7
STRUCTURAL COLUMN
5/8" FIRE-RATED GYPSUM BOARD PAINTED (FOIL BACKED)
SOUTH
NORTH

DISTRICT MANAGER'S OFFICE ELEVATIONS 1/4" = 1'-0"



2x2 ACOUS. PANELS
METAL PICTURE HANGING STRIP SEE SPEC. 10802
VINYL WALLCOVERING
4" RUBBER BASE RECESSED FOR MAT

VESTIBULE 'D' EAST WALL 1/4" = 1'-0"

FIGURE NO. 12

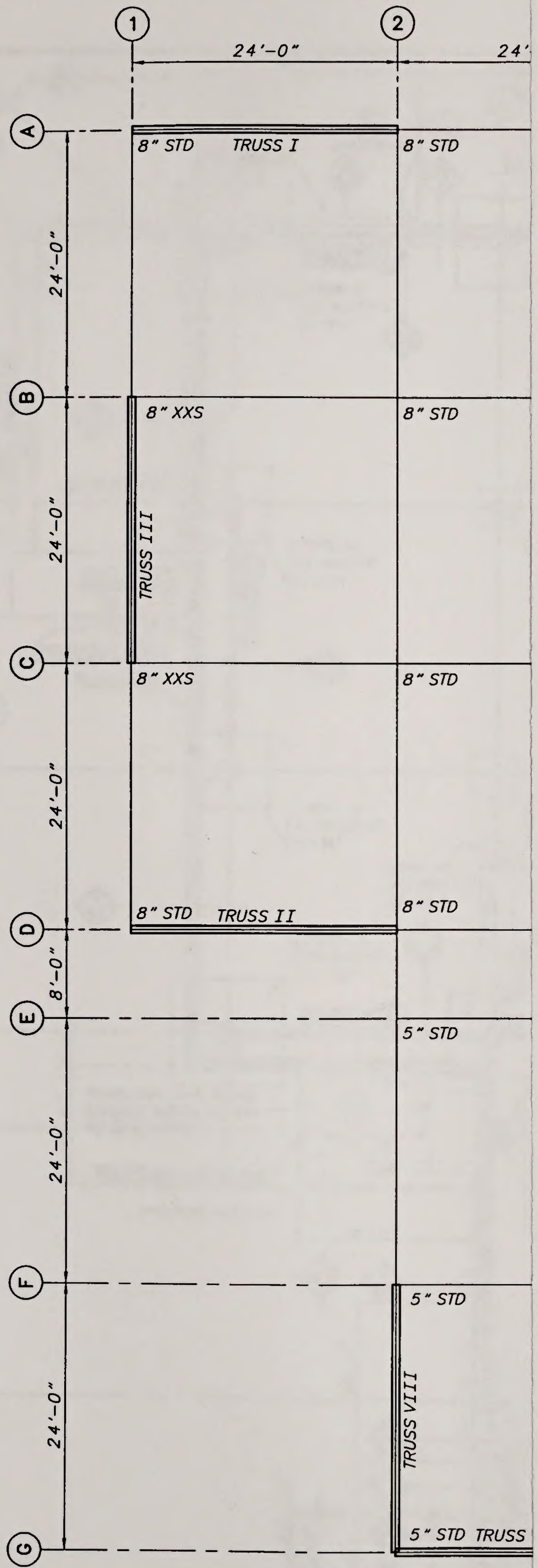
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENT.

SECOND FLOOR REFLECTED CEILING PLAN
BOISE DISTRICT OFFICE
IDAHO

DESIGNED cl
DRAWN
CHECKED ArX
RECOMMENDED
RECOMMENDED
APPROVED Richard G Gage

A 12

SCALES AS NOTED
DATE JUNE 1978
SHEET 21 OF 50
DRAWING NO. 46-4000-9151
1027

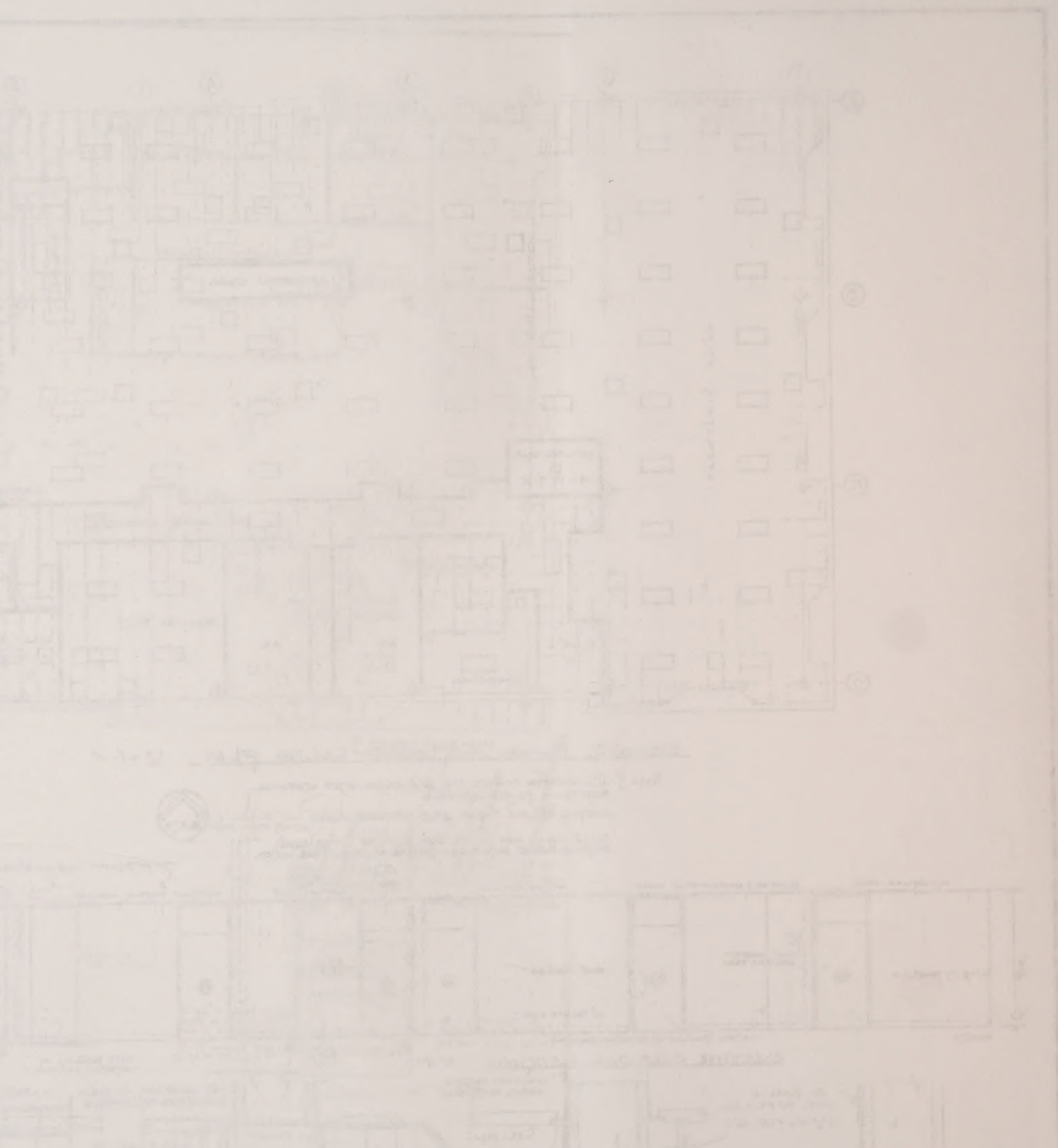


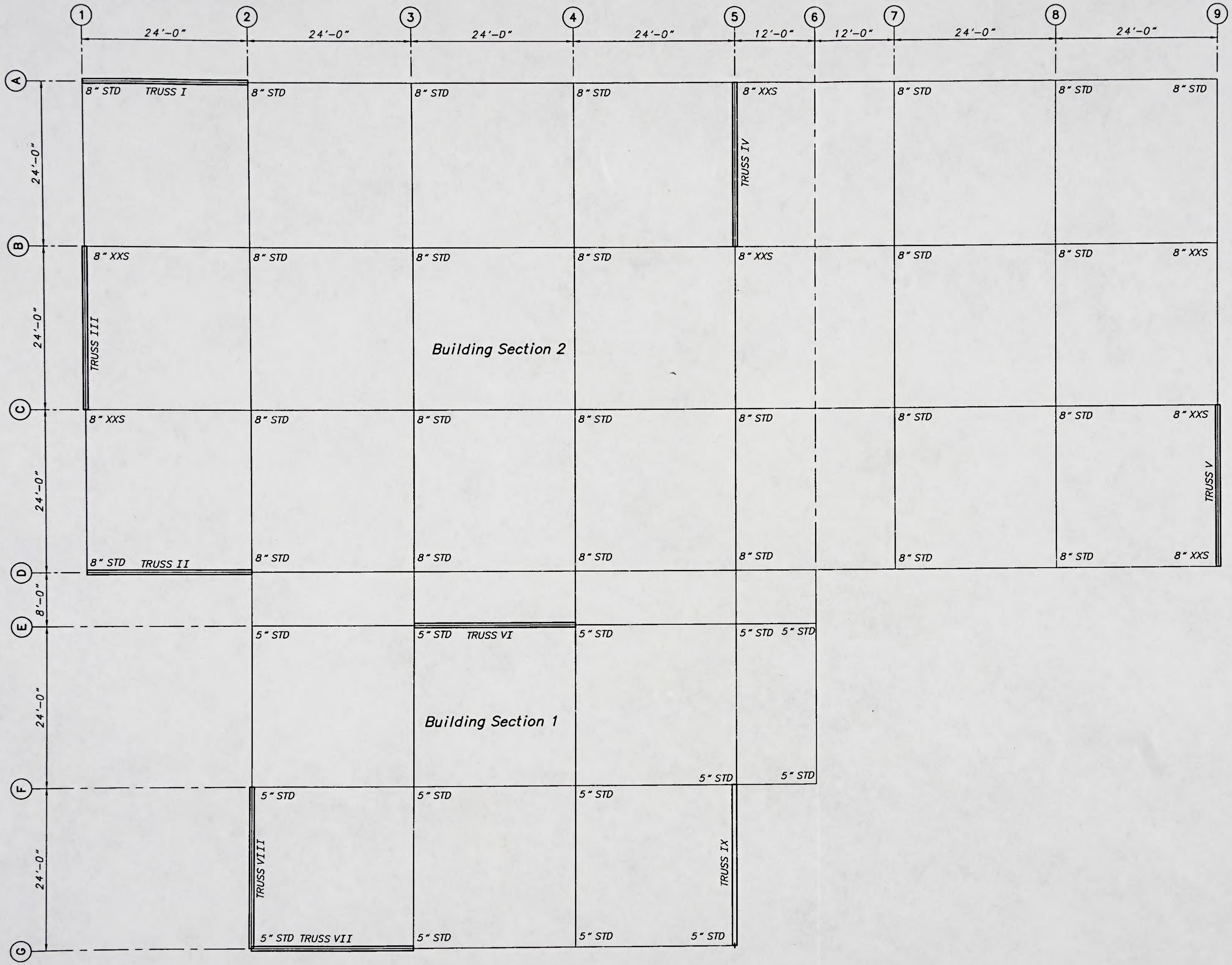
ALWAYS THINK **SAFETY**

BLM Boise District Office
Simplified Building Plan

CADD SYSTEM	CADD FILENAME	DATE AND TIME PLOTTED
AutoCAD	Unknown	Not Plotted
		Figure No. 13

USER



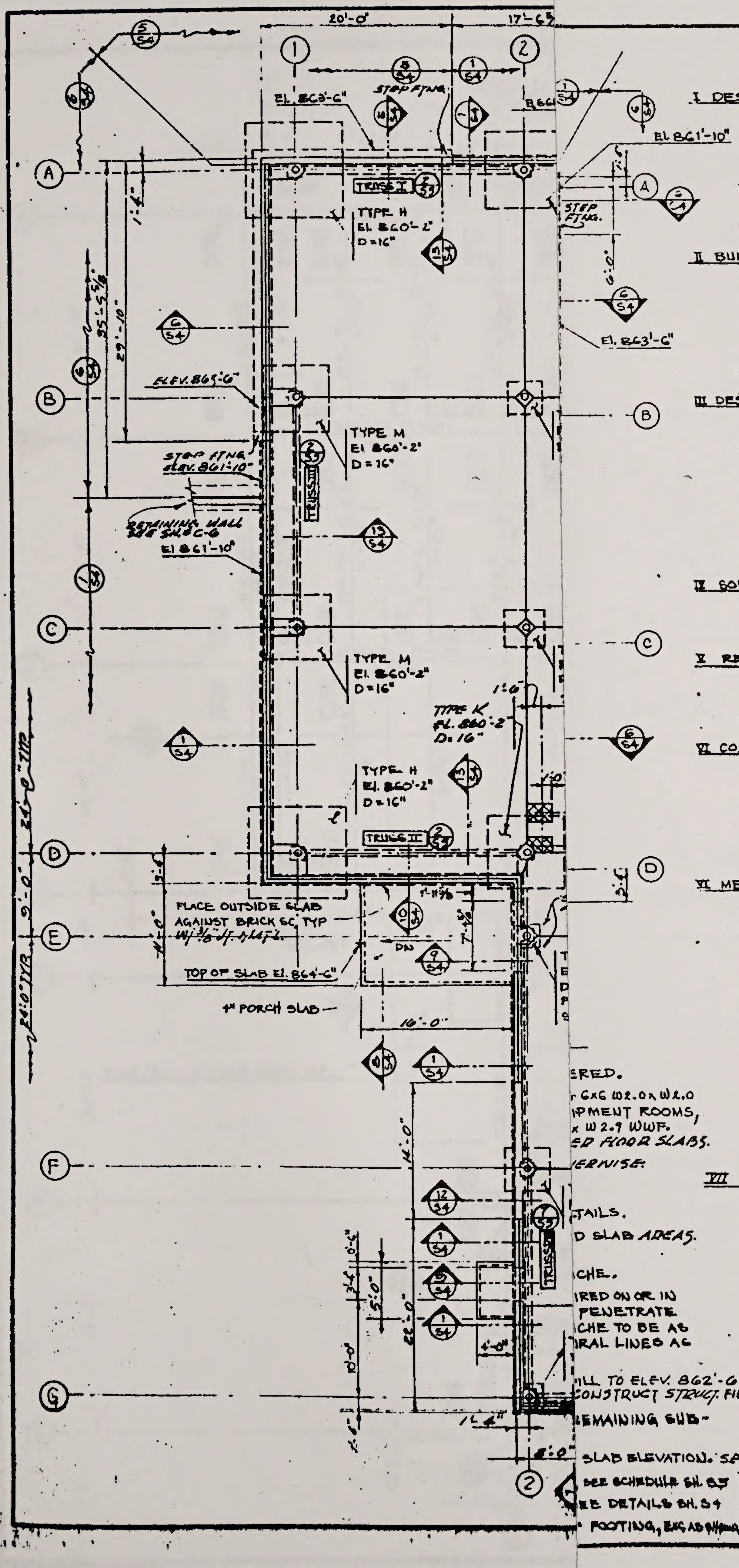


ALWAYS THINK SAFETY

BLM Boise District Office
Simplified Building Plan

CADD SYSTEM AutoCAD	CADD FILENAME Unknown	DATE AND TIME PLOTTED Not Plotted
		Figure No. 13

USER



STRUCTURAL NOTES

I DESIGN LOADS:

A. LIVE LOADS — 1-ROOF ______________ 30 P.S.F.
2-FLOOR
GENERAL __________ 65 P.S.F.
CORRIDOR & STAIRS ___ 100 P.S.F.

B. LATERAL LOADS — 1-SEISMIC ____________ ZONE 2
2-WIND ______________ 20 P.S.F.

C. DEAD LOADS - __________________ ACTUAL

II BUILDING CODES:

A. ACI BLDG. CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318)

B. ACI CODE OF STANDARD PRACTICE (ACI 315)

C. CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS & BRIDGES, AISC

D. UNIFORM BUILDING CODE, 1976, ICBO

E. AMERICAN WELDING SOCIETY CODE, D1.1-75

III DESIGN STRESSES:

A. CONCRETE AT 28 DAYS (TYPE 1) ____________ F'C = 3,000 P.S.I.

B. REINFORCING STEEL: (ASTM 615, GRADE 40) ____ FY = 40,000 P.S.I.

C. STRUCTURAL STEEL BEAMS AND CHANNELS _____ FY = 50,000 P.S.I.
REMAINDER (PLATES ANGLES & COLUMNS) _____ FY = 36,000 P.S.I.

D. BOLTS — 1-ALL 3/4" ∅ UNLESS NOTED.
2-A-307 BOLTS IN WOOD TO WOOD, METAL TO WOOD & ANCHOR BOLTS.
3-A-325X BOLTS STEEL TO STEEL CONNECTIONS.

IV SOIL BEARING PRESSURE:

A. DEAD LOAD PLUS LIVE LOAD, TOTAL __________ 6,000 P.S.F.

B. LOADING COMINATIONS INCLUDING SEISMIC LOAD ___ 8,000 P.S.F.

V REINFORCING STEEL

A. ACI CODE OF STANDARD PRACTICE (ACI 315) TO GOVERN FABRICATION OF ALL REINFORCING STEEL UNLESS SHOWN OTHERWISE ON DRAWING.

B. SEE APPLICABLE TABLE FOR MINIMUM LAP FOR SPLICES.

VI CONCRETE COVERAGE FOR REINFORCING STEEL

A. FOOTINGS ______________________ 3" CLEAR TO SOIL

B. PEDESTALS ______________________ 1 1/2" TO TIES

C. WALLS (EXPOSED TO EARTH OR WEATHER) ___ 2" EXC. AS SHOWN

D. WALLS (NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND) ____________ 3/4"

VI METAL ROOF DECK & METAL STRUCTURAL COMPOSITE FLOOR DECK

A. METAL DECK TO BE 1 1/2" GALVANIZED DECK.

B. STEEL DECK INSTITUTE INTERMEDIATE RIB, TYPE IR, 18 GAGE.

C. GALVANIZING TO BE LIGHT COMMERCIAL WEIGHT, 0.6 OZ./FT^2.

D. WELD TO BEAMS AND PROVIDE WELDED OR BUTTON PUNCH CONNECTIONS BETWEEN SHEETS AS REQUIRED TO PROVIDE DIAPHRAM SHEAR CAPACITY OF 375#/LIN. FT.

E. 18-GAUGE METAL DECKING AS SPECIFIED IS THE MINIMUM ALLOWABLE. MANUFACTURER TO INCREASE GUAGE IN ANY AREA WHERE HIS 18-GA. DECKING WILL NOT MEET THE SHEAR REQUIREMENTS. EXTRA WELDS MAY BE PROVIDED IN LIEU OF INCREASING THE GAUGE PROVIDED MANUFACTURER PROVIDES TEST DATA OR CALCULATIONS SHOWING THE DECK WILL HANDLE THE SPECIFIED LOADS.

F. SEE SPECIFICATIONS FOR DESIGN REQUIREMENTS

VII DIMENSIONS

A. ALL DIMENSIONS AND ELEVATIONS ARE SHOWN IN FEET AND INCHES FOR THE CONVENIENCE OF THE CONSTRUCTION CRAFTS.

FIGURE NO. 14

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

FOUNDATION & 1ST FLOOR PLAN
BOISE DISTRICT OFFICE
IDAHO

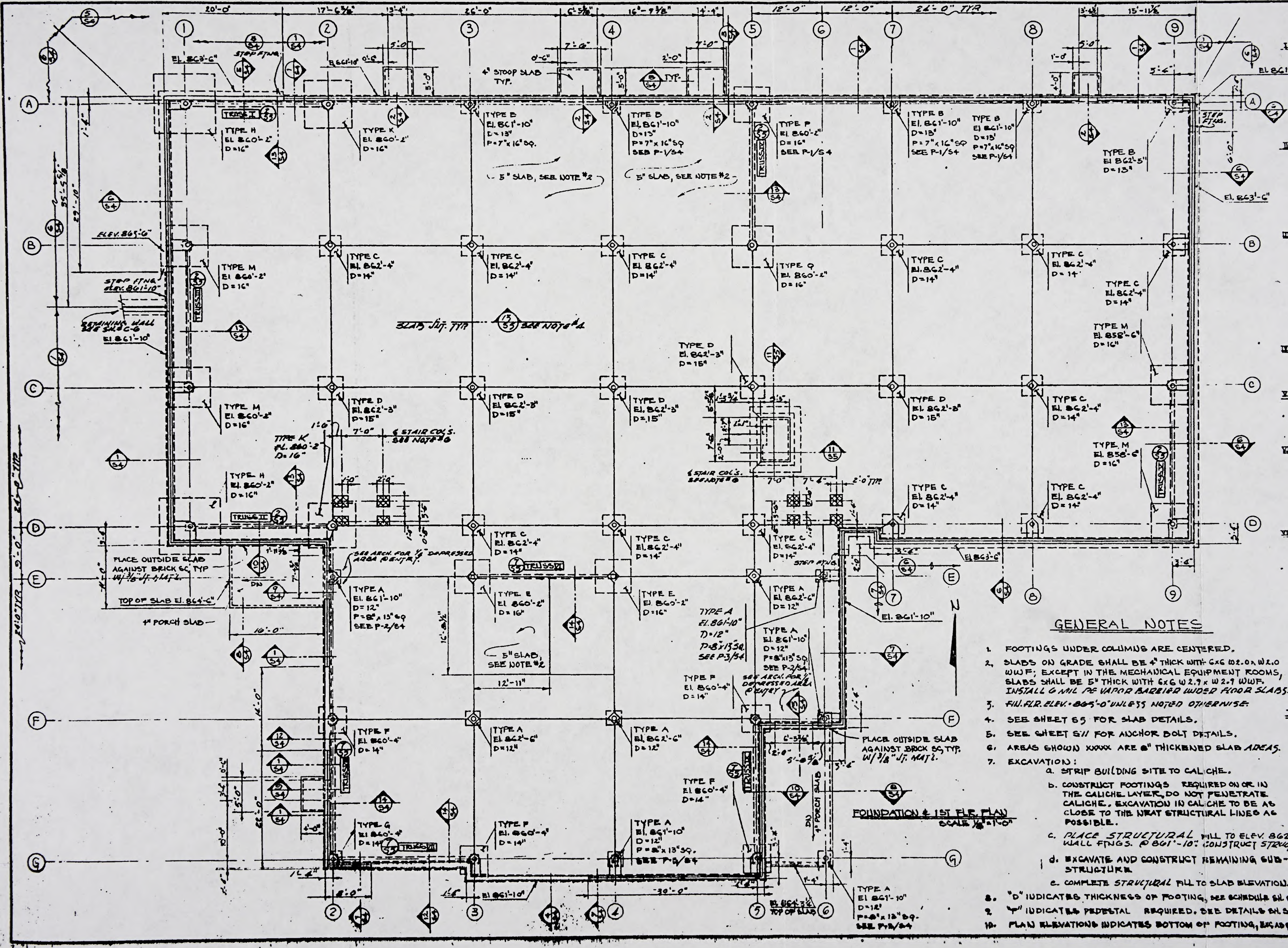
DESIGNED KAR	RECOMMENDED
DRAWN	RECOMMENDED
CHECKED	APPROVED

S1

SCALE 1/8" = 1'-0"

DATE JULY 1978 | SHEET 23 OF 30

DRAWING NO. YA-400-9131 | 1039



FOUNDATION & 1ST FLR. PLAN
SCALE 1/8"=1'-0"

STRUCTURAL NOTES

I DESIGN LOADS:

A. LIVE LOADS — 1-ROOF ———— 30 P.S.F.
2-FLOOR
GENERAL ———— 65 P.S.F.
CORRIDOR & STAIRS ———— 100 P.S.F.

B. LATERAL LOADS — 1-SEISMIC ———— ZONE 2
2-WIND ———— 20 P.S.F.

C. DEAD LOADS - ———— ACTUAL

II BUILDING CODES:

A. ACI BLDG. CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318)

B. ACI CODE OF STANDARD PRACTICE (ACI 315)

C. CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS & BRIDGES, AISC

D. UNIFORM BUILDING CODE, 1976, ICBO

E. AMERICAN WELDING SOCIETY CODE, D1.1-75

III DESIGN STRESSES:

A. CONCRETE AT 28 DAYS (TYPE 1) ———— F'C = 3,000 P.S.I.

B. REINFORCING STEEL: (ASTM 615, GRADE 40) ———— FY = 40,000 P.S.I.

C. STRUCTURAL STEEL BEAMS AND CHANNELS ———— FY = 50,000 P.S.I.
REMAINDER (PLATES, ANGLES & COLUMNS) ———— FY = 36,000 P.S.I.

D. BOLTS ———— 1-ALL 3/4" φ UNLESS NOTED.
2-A-307 BOLTS IN WOOD TO WOOD, METAL TO WOOD & ANCHOR BOLTS.
3-A-325X BOLTS STEEL TO STEEL CONNECTIONS.

IV SOIL BEARING PRESSURE:

A. DEAD LOAD PLUS LIVE LOAD, TOTAL ———— 6,000 P.S.F.

B. LOADING COMINATIONS INCLUDING SEISMIC LOAD ———— 8,000 P.S.F.

V REINFORCING STEEL

A. ACI CODE OF STANDARD PRACTICE (ACI 315) TO GOVERN FABRICATION OF ALL REINFORCING STEEL UNLESS SHOWN OTHERWISE ON DRAWING.

B. SEE APPLICABLE TABLE FOR MINIMUM LAP FOR SPLICES.

VI CONCRETE COVERAGE FOR REINFORCING STEEL

A. FOOTINGS ———— 3" CLEAR TO SOIL

B. PEDESTALS ———— 1 1/2" TO TIES

C. WALLS (EXPOSED TO EARTH OR WEATHER) ———— 2" EXC. AS SHOWN

D. WALLS (NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND) ———— 3/4"

VI METAL ROOF DECK & METAL STRUCTURAL COMPOSITE FLOOR DECK

A. METAL DECK TO BE 1 1/2" GALVANIZED DECK.

B. STEEL DECK INSTITUTE INTERMEDIATE RIB, TYPE IR, 18 GAGE.

C. GALVANIZING TO BE LIGHT COMMERCIAL WEIGHT, 0.6 OZ./FT^2.

D. WELD TO BEAMS AND PROVIDE WELDED OR BUTTON PUNCH CONNECTIONS BETWEEN SHEETS AS REQUIRED TO PROVIDE DIAPHRAM SHEAR CAPACITY OF 375#/LIN. FT.

E. 18-GAUGE METAL DECKING AS SPECIFIED IS THE MINIMUM ALLOWABLE. MANUFACTURER TO INCREASE GUAGE IN ANY AREA WHERE HIS 18-GA. DECKING WILL NOT MEET THE SHEAR REQUIREMENTS. EXTRA WELDS MAY BE PROVIDED IN LIEU OF INCREASING THE GAUGE PROVIDED MANUFACTURER PROVIDES TEST DATA OR CALCULATIONS SHOWING THE DECK WILL HANDLE THE SPECIFIED LOADS.

F. SEE SPECIFICATIONS FOR DESIGN REQUIREMENTS

VII DIMENSIONS

A. ALL DIMENSIONS AND ELEVATIONS ARE SHOWN IN FEET AND INCHES FOR THE CONVENIENCE OF THE CONSTRUCTION CRAFTS.

GENERAL NOTES

1. FOOTINGS UNDER COLUMNS ARE CENTERED.
2. SLABS ON GRADE SHALL BE 4" THICK WITH 6x6 W2.0 x W2.0 WWF; EXCEPT IN THE MECHANICAL EQUIPMENT ROOMS, SLABS SHALL BE 5" THICK WITH 6x6 W2.9 x W2.9 WWF. INSTALL 6 MIL PE VAPOR BARRIER UNDER FLOOR SLABS.
3. FIN. FLR. ELEV. = 865'-0" UNLESS NOTED OTHERWISE.
4. SEE SHEET S5 FOR SLAB DETAILS.
5. SEE SHEET S11 FOR ANCHOR BOLT DETAILS.
6. AREAS SHOWN XXXXX ARE 8" THICKENED SLAB AREAS.
7. EXCAVATION:
   a. STRIP BUILDING SITE TO CALICHE.
   b. CONSTRUCT FOOTINGS REQUIRED ON OR IN THE CALICHE LAYER, DO NOT PENETRATE CALICHE. EXCAVATION IN CALICHE TO BE AS CLOSE TO THE NEAT STRUCTURAL LINES AS POSSIBLE.
   c. PLACE STRUCTURAL FILL TO ELEV. 862'-6". COMPLETE WALL FTNGS. @ 861'-10". CONSTRUCT STRUCT. FILL TO 863'-6.
   d. EXCAVATE AND CONSTRUCT REMAINING SUB-STRUCTURE
   e. COMPLETE STRUCTURAL FILL TO SLAB ELEVATION. SEE SPECS.
8. "D" INDICATES THICKNESS OF FOOTING, SEE SCHEDULE SH. S3
9. "P" INDICATES PEDESTAL REQUIRED. SEE DETAILS SH. S4
10. PLAN ELEVATIONS INDICATES BOTTOM OF FOOTING, EXC. AS SHOWN

FIGURE No. 14

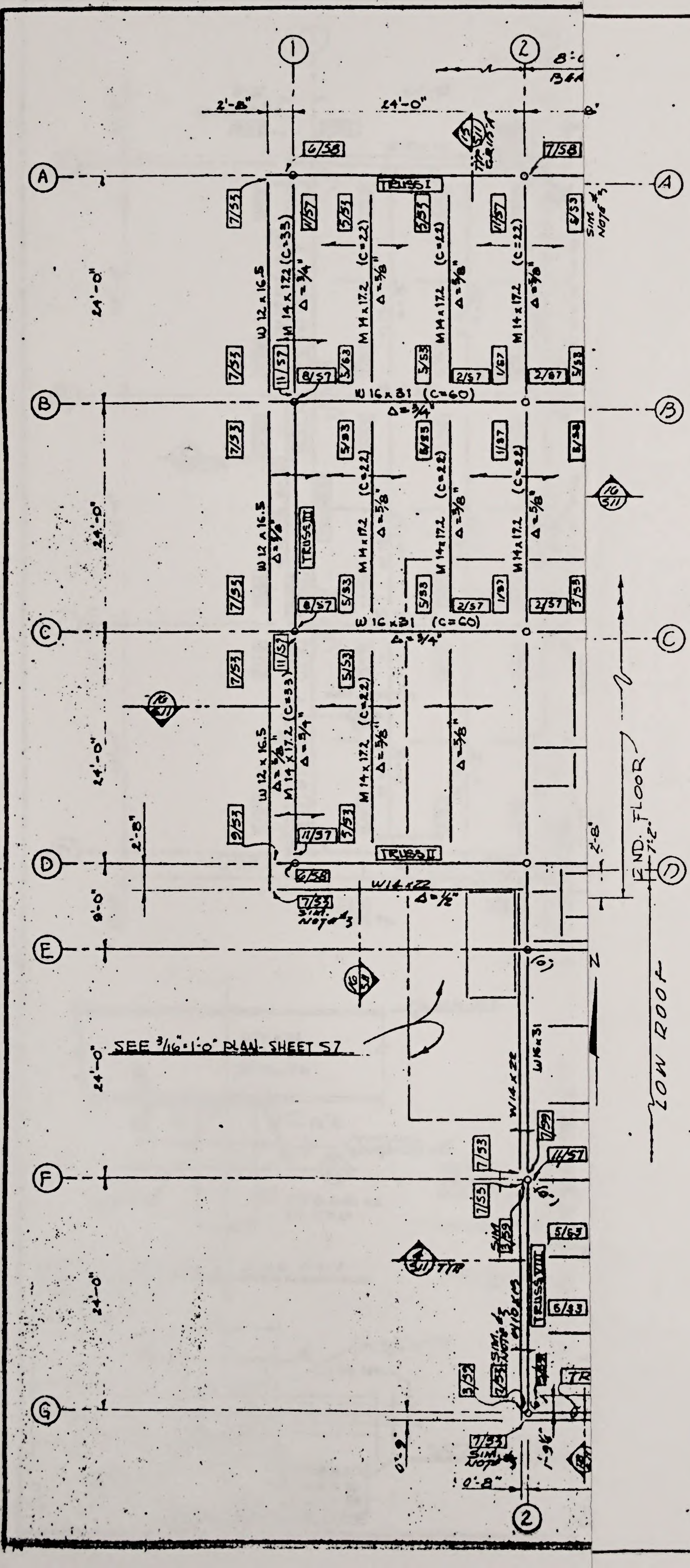
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

FOUNDATION & 1ST FLOOR PLAN
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAR
DRAWN KAR
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

S1

SCALE 1/8" = 1'-0"
DATE JULY 1978
SHEET 23 OF 30
DRAWING NO. YA-400-9131
1039



GENERAL NOTES

1. – SIMILAR CONNECTION WITH TS 5 O.D. COLUMN
2. – SINGLE ANGLE OUTSIDE
3. – SINGLE ANGLE INSIDE
4 – FOR ROOF DECK SEE NOTE #4 SH.# 3
5 – ▭ INDICATES BEAM CONNECTION DETAIL
6 – ELEVATION ON LOW ROOF PLAN INDICATED AS PLUS (+) AND MINUS (–) ARE TOP OF STEEL ELEVATIONS MEASURED FROM ELEVATION 877'-4".
7 – (C=33) INDICATES THE NUMBER OF 3/4"φ x 3" STUDS REQUIRED. STUDS ARE TO BE LOCATED DIRECTLY OVER THE BEAM WEB AND EQUALLY SPACED ABOUT MIDSPAN OF THE BEAM (SEE SPECS)
8 – Δ=7/8" INDICATES THE BEAM CAMBER REQUIRED. IF Δ IS NOT SHOWN NO CAMBER IS REQUIRED
9 – FLOOR DECK SHALL BE 1½ COMPOSITE FLOOR DECK W/METAL THICKNESS NOT LESS THAN 0.0474".
SEE SPECS FOR DETAILED REQUIREMENTS
10. – REINFORCE STRUCTURAL SLABS WITH 6x6-W2.9xW2.9 W.W.F. FABRIC. SPLICES SHALL BE NOT LESS THAN ONE WIRE SPACE PLUS 2" IN ANY DIRECTION.
11. – TOP OF STEEL FLOOR BEAMS, GIRDERS AND SPANDRELS ON THE 2ND FLOOR PLAN IS 4" BELOW THE FINISHED FLOOR ELEVATION OF 877-8".
12. – VERIFY ALL OPENINGS (SIZE & LOCATION) WITH MECHANICAL CONTRACTOR
13 – OPPOSITE HAND CONNECTIONS NOT INDICATED – USE DETAILS AS OPP. HND. BY IMPLICATION AS REQ'D. BY LAYOUT OF STRUCTURE.
14 · → INDICATES DIRECTION OF DECK SHEETS
15 · REINFORCE STRUCTURAL FLR. SLAB WITH 6x6-W2.9xW2.9 WELDED WIRE FABRIC.
16 – DIMENSION ℄ BM. TO EDGE OF PL = 0'-11¼" DETAIL TYP. @ SOUTH EDGE OF MECH. CHASE.
17 – PROVIDE 2-#5 CONT. IN ALL EDGES OF THE STRUCT. SLAB.
18 – INSTALL EDGE BAR ALONG GRIDLINES E & G OF THE LOW ROOF.

FIGURE NO. 15

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

2ND. FLOOR & LOW ROOF FRAMING PLAN
BOISE DISTRICT OFFICE
BOISE, IDAHO

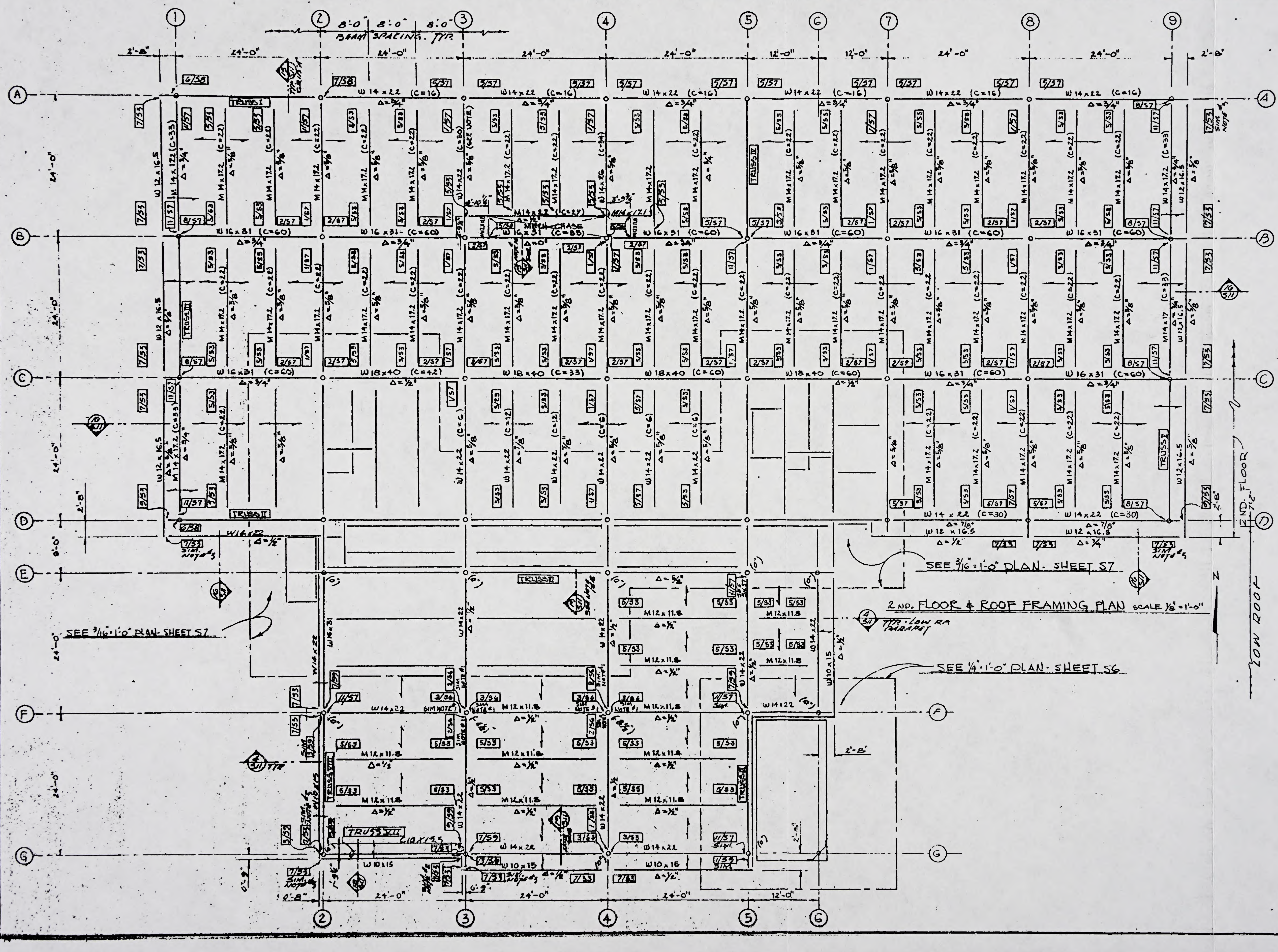
DESIGNED KAR
DRAWN PHF & KAB
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

S 2

SCALE AS SHOWN

DATE JULY 1978
SHEET 24 OF 50

DRAWING NO. YA-400-9181
1039



GENERAL NOTES

1. – SIMILAR CONNECTION WITH T6 5 O.D. COLUMN
2. – SINGLE ANGLE OUTSIDE
3. – SINGLE ANGLE INSIDE
4 – FOR ROOF DECK SEE NOTE #4 SH. #3
5 – ▭ INDICATES BEAM CONNECTION DETAIL
6 – ELEVATION ON LOW ROOF PLAN INDICATED AS PLUS (+) AND MINUS (−) ARE TOP OF STEEL ELEVATIONS MEASURED FROM ELEVATION 877'- 4".
7 – (C=33) INDICATES THE NUMBER OF 3/4"⌀ x 3" STUDS REQUIRED. STUDS ARE TO BE LOCATED DIRECTLY OVER THE BEAM WEB AND EQUALLY SPACED ABOUT MIDSPAN OF THE BEAM (SEE SPECS)
8 – Δ=7/8" INDICATES THE BEAM CAMBER REQUIRED. IF Δ IS NOT SHOWN NO CAMBER IS REQUIRED
9 – FLOOR DECK SHALL BE 1½ COMPOSITE FLOOR DECK W/METAL THICKNESS NOT LESS THAN 0.0474". SEE SPECS FOR DETAILED REQUIREMENTS
10. – REINFORCE STRUCTURAL SLABS WITH 6x6-W2.9xW2.9 W.W.F. FABRIC. SPLICES SHALL BE NOT LESS THAN ONE WIRE SPACE PLUS 2" IN ANY DIRECTION.
11. – TOP OF STEEL FLOOR BEAMS, GIRDERS AND SPANDRELS ON THE 2ND FLOOR PLAN IS 4" BELOW THE FINISHED FLOOR ELEVATION OF 877-8".
12. – VERIFY ALL OPENINGS (SIZE & LOCATION) WITH MECHANICAL CONTRACTOR
13 – OPPOSITE HAND CONNECTIONS NOT INDICATED - USE DETAILS AS OPP. HND. BY IMPLICATION AS REQ'D. BY LAYOUT OF STRUCTURE.
14 – ⟶ INDICATES DIRECTION OF DECK SHEETS
15 – REINFORCE STRUCTURAL FLR. SLAB WITH 6x6 W2.9xW2.9 WELDED WIRE FABRIC.
16 – DIMENSION ℄ BM. TO EDGE OF PL = 0'-11¼" DETAIL TYP. @ SOUTH EDGE OF MECH. CHASE.
17 – PROVIDE 2-#5 CONT. IN ALL EDGES OF THE STRUCT. SLABS.
18 – INSTALL EDGE BAR ALONG GRIDLINES E & G OF THE LOW ROOF.

FIGURE NO. 15

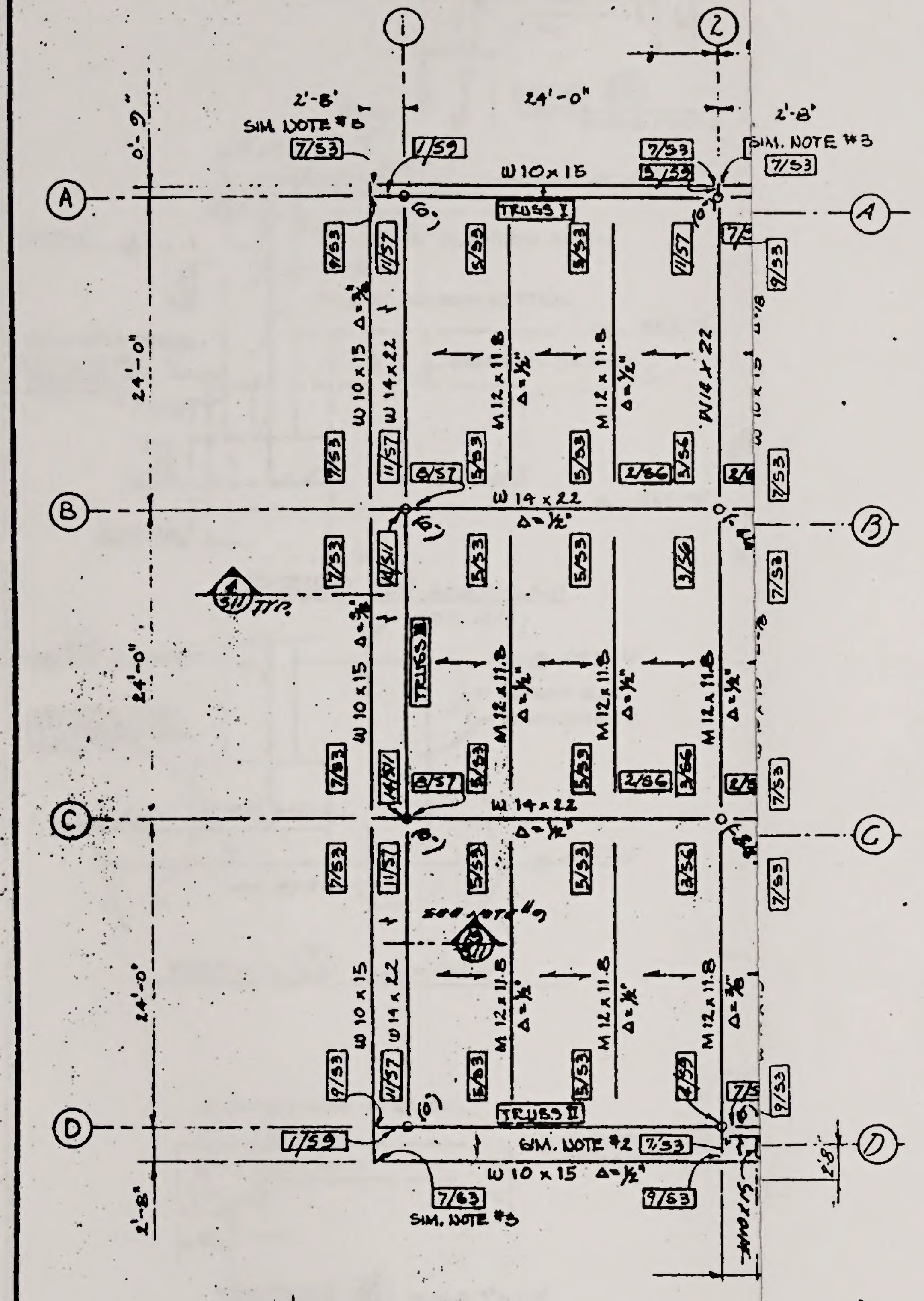
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

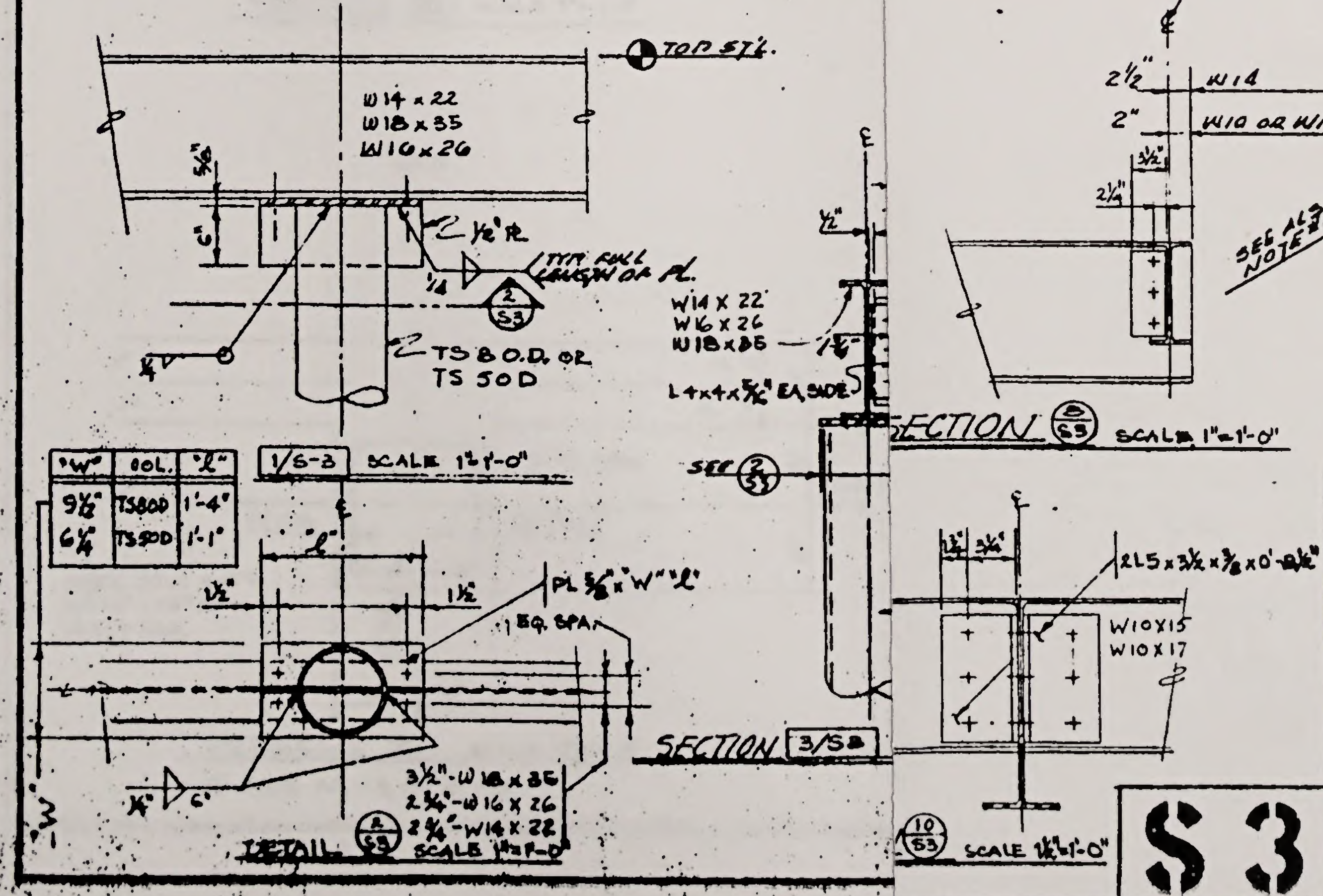
2ND. FLOOR & LOW ROOF FRAMING PLAN
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR
DRAWN PH; & KAR
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

S 2

SCALE AS SHOWN
DATE JULY 1978
SHEET 24 OF 50
DRAWING NO. YA-400-9181
1039





"W"	COL.	"l"
9½"	TS8OD	1'-4"
6¼"	TS5OD	1'-1"

GENERAL NOTES

1. ½" WELD RETURN, TOP & BOTT.
2. SINGLE ANGLE OUTSIDE
3. SINGLE ANGLE INSIDE
4. ROOF DECK TO BE 1½"-18 GAGE GALV. STEEL ROOF DECK; 2 SPAN CONTINUOUS MIN.; TYPE 1R - STEEL DECK INSTITUTE.
5. ▭ INDICATES BEAM CONNECTION DETAILS.
6. ELEVATIONS ON ROOF PLAN INDICATED AS PLUS (+) OR MINUS (-) ARE TOP OF STEEL ELEVATIONS MEASURED FROM ELEV. 890'-2½".
7. CONNECTIONS MAY BE MODIFIED AS REQD BY THE PROPOSED ERECTION SEQUENCE; - PROVIDED SUCH CHANGES ARE DETAILED ON THE SHOP DRAWINGS AND ARE APPROVED BY THE CONTRACTING OFFICER.
8. WHERE W10 OR W12 CONNECT TO W14x22. OR CONNECT TO A BM. OR PL. OPPOSITE W14x22: - (1) LOCATE TOP OF CONN. ANGLE TO FIT W14 & (2) USE 2 BOLTS IN W10 OR W12 BY OMITTING THE BOTT. BOLT & SHORTENING THE ANGLE TO FIT.
9. INSTALL EDGE BAR ALONG GRID LINES 1, 5, & 9 OF THE HIGH ROOF.
10. PROVIDE LATERAL SUPPORTS FOR ELEVATOR FURNISHED @ APPROX. 2R LEVEL.

FIGURE NO. 16

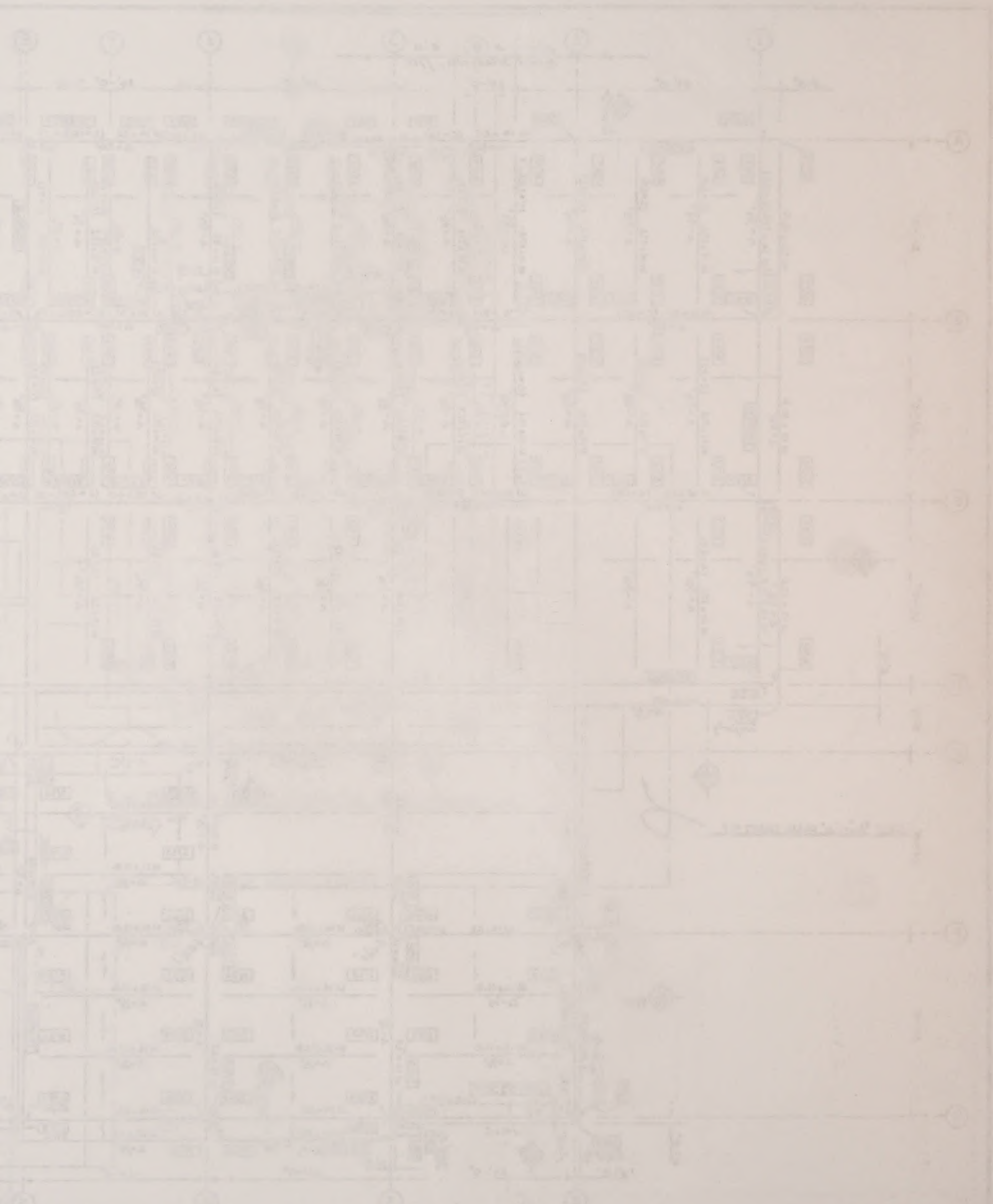
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

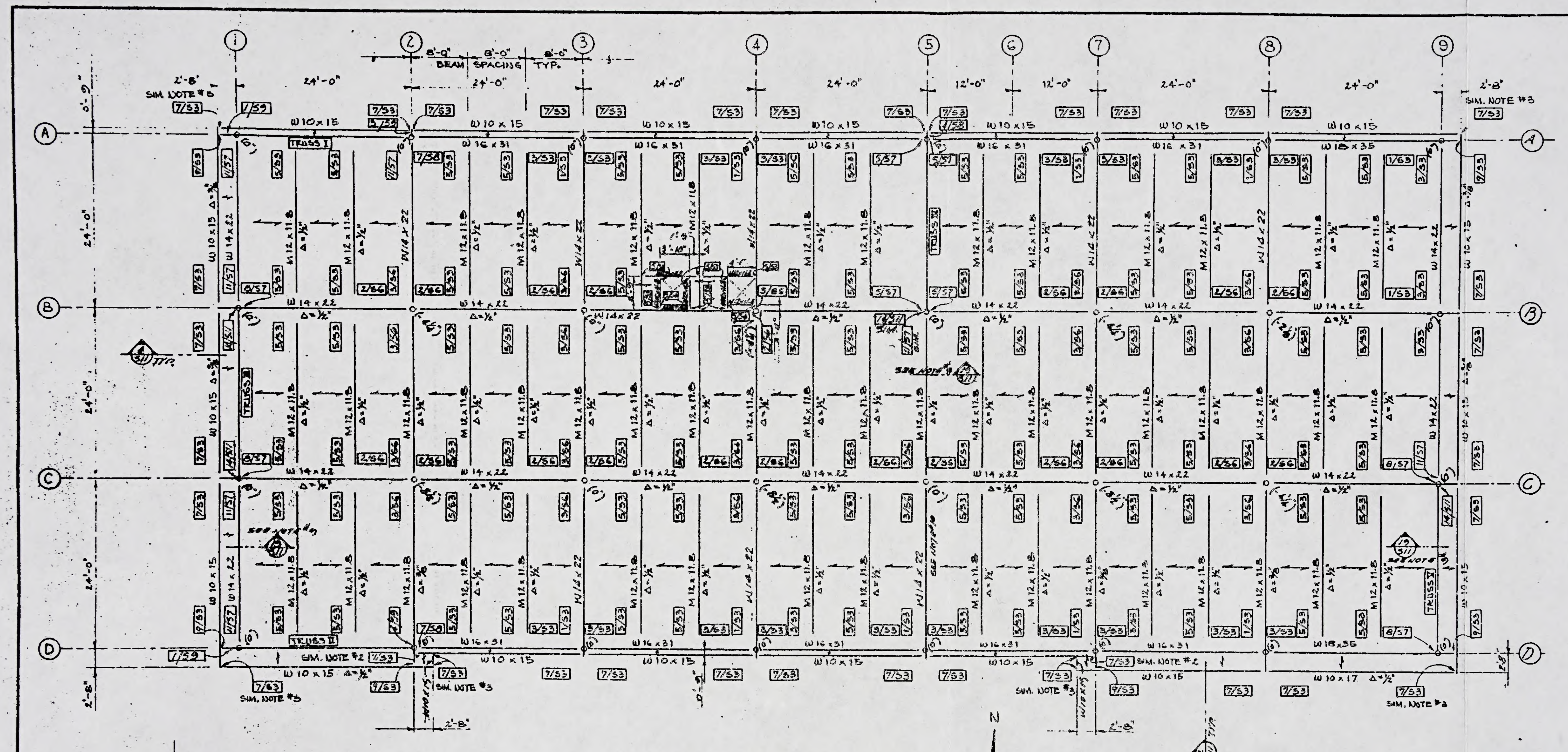
HIGH ROOF FRAMING PLAN AND DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED Wayne A. Wilson
APPROVED Richard E. Engw

S3

SCALE AS SHOWN
DATE JULY 1978
SHEET 25 OF 50
DRAWING NO. YA-A00-915
1039

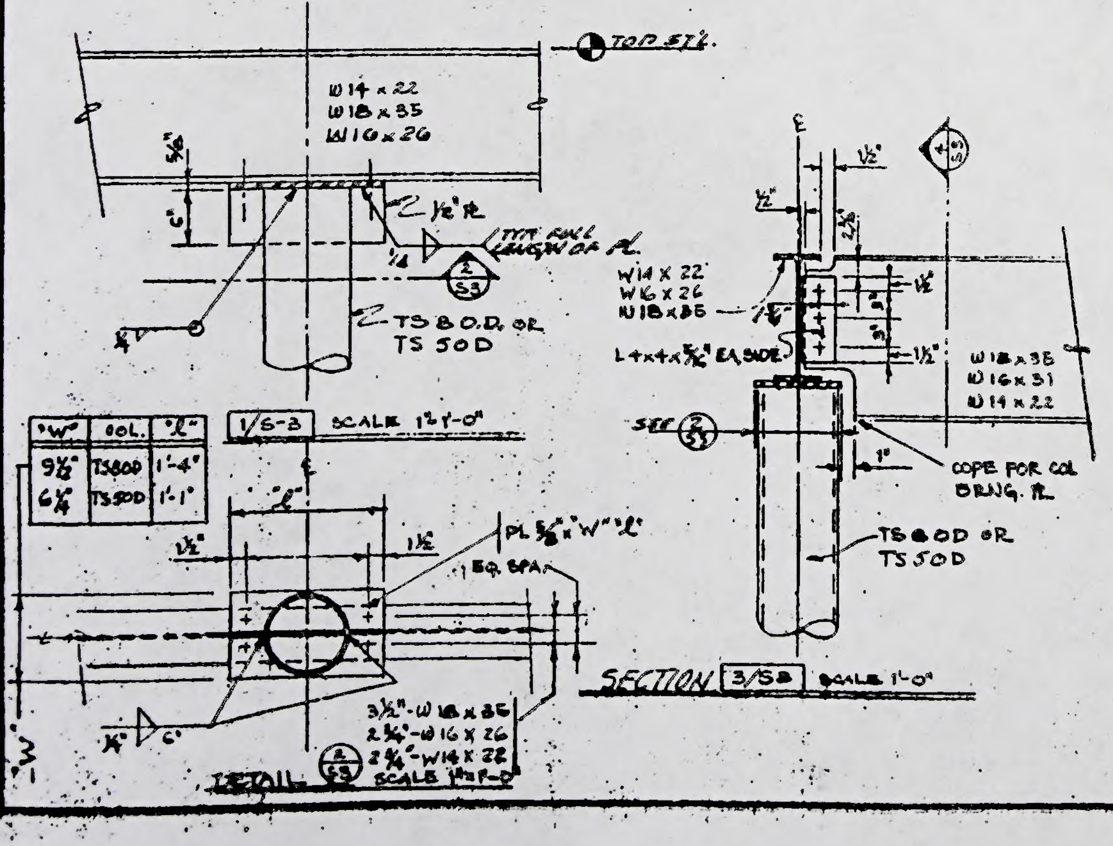




HIGH ROOF FRAMING PLAN SCALE 1/8"=1'-0"

GENERAL NOTES

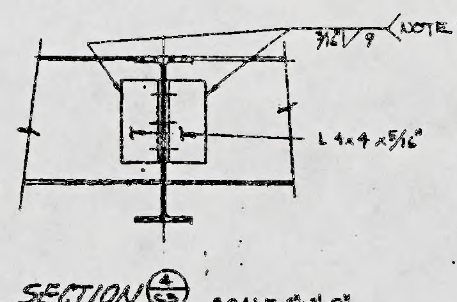
1. 1/2" WELD RETURN, TOP & BOTT.
2. SINGLE ANGLE OUTSIDE
3. SINGLE ANGLE INSIDE
4. ROOF DECK TO BE 1½"-18 GAGE GALV. STEEL ROOF DECK; 2 SPAN CONTINUOUS MIN.; TYPE IR - STEEL DECK INSTITUTE.
5. ☐ INDICATES BEAM CONNECTION DETAILS.
6. ELEVATIONS ON ROOF PLAN INDICATED AS PLUS (+) OR MINUS (−) ARE TOP OF STEEL ELEVATIONS MEASURED FROM ELEV. 890'-2½".
7. CONNECTIONS MAY BE MODIFIED AS REQD BY THE PROPOSED ERECTION SEQUENCE; - PROVIDED SUCH CHANGES ARE DETAILED ON THE SHOP DRAWINGS AND ARE APPROVED BY THE CONTRACTING OFFICER.
8. WHERE W10 OR W12 CONNECT TO W14x22. OR CONNECT TO A BM. OR PL. OPPOSITE W14x22:- (1) LOCATE TOP OF CONN. ANGLE TO FIT W14 - & (2) USE 2 BOLTS IN W10 OR W12 BY OMITTING THE BOTT. BOLT & SHORTENING THE ANGLE TO FIT.
9. INSTALL EDGE BAR ALONG GRID LINES 1, 5, & 9 OF THE HIGH ROOF.
10. PROVIDE LATERAL SUPPORTS FOR ELEVATOR FURNISHED @ APPROX. RR LEVEL.



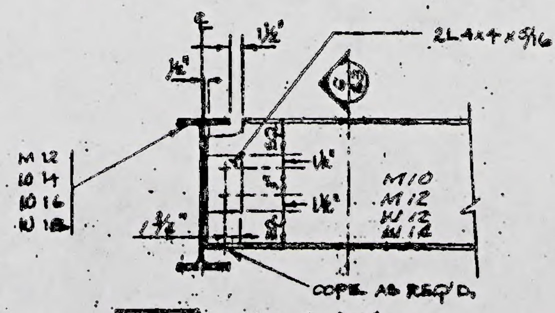
"W"	COL.	"L"
9½"	TS8OD	1'-4"
6⅞"	TS5OD	1'-1"

DETAIL 1/53 SCALE 1½"=1'-0"

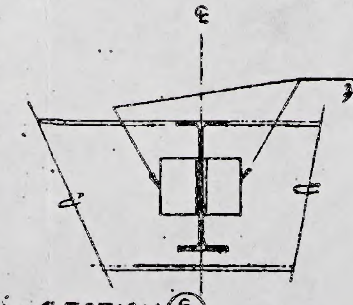
SECTION 3/53 SCALE 1"=1'-0"



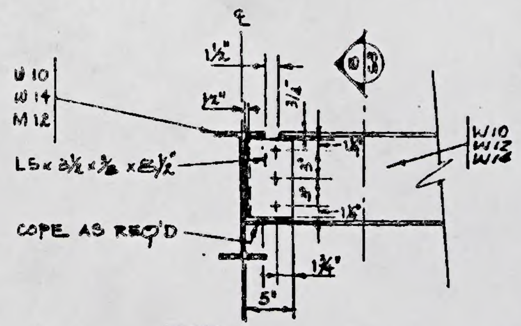
SECTION 4/53 SCALE 1"=1'-0"



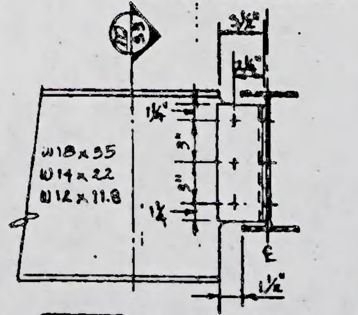
5/53 SCALE 1"=1'-0"



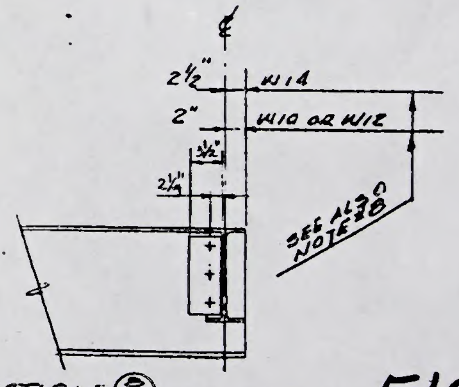
SECTION 6/53 SCALE 1"=1'-0"



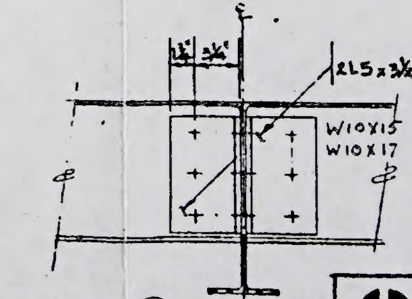
7/63 SCALE 1"=1'-0"



9/53 SCALE 1½"=1'-0"



SECTION 8/53 SCALE 1"=1'-0"



SECTION 10/53 SCALE 1½"=1'-0"

FIGURE NO. 16

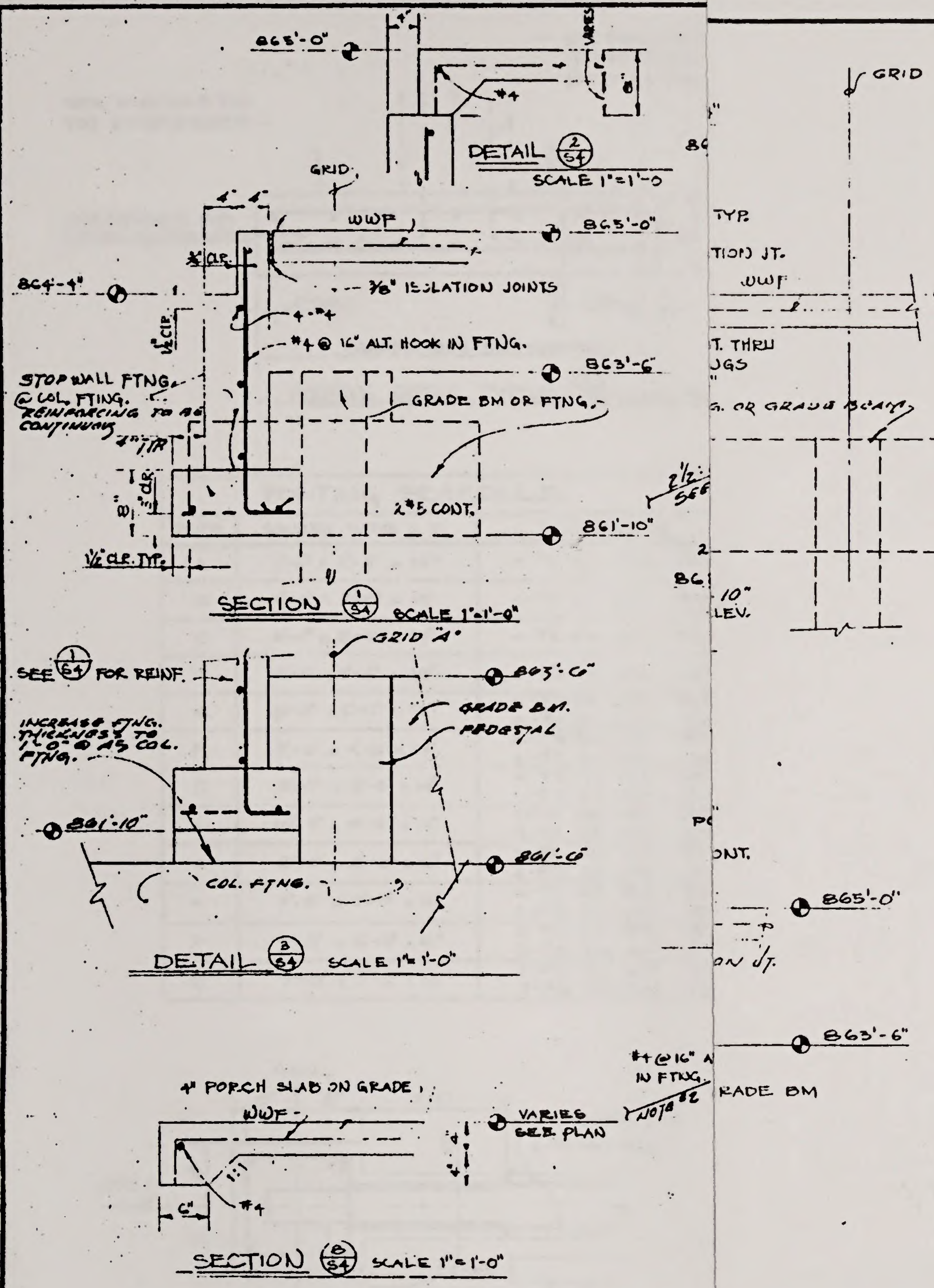
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING DENVER SERVICE CENTER

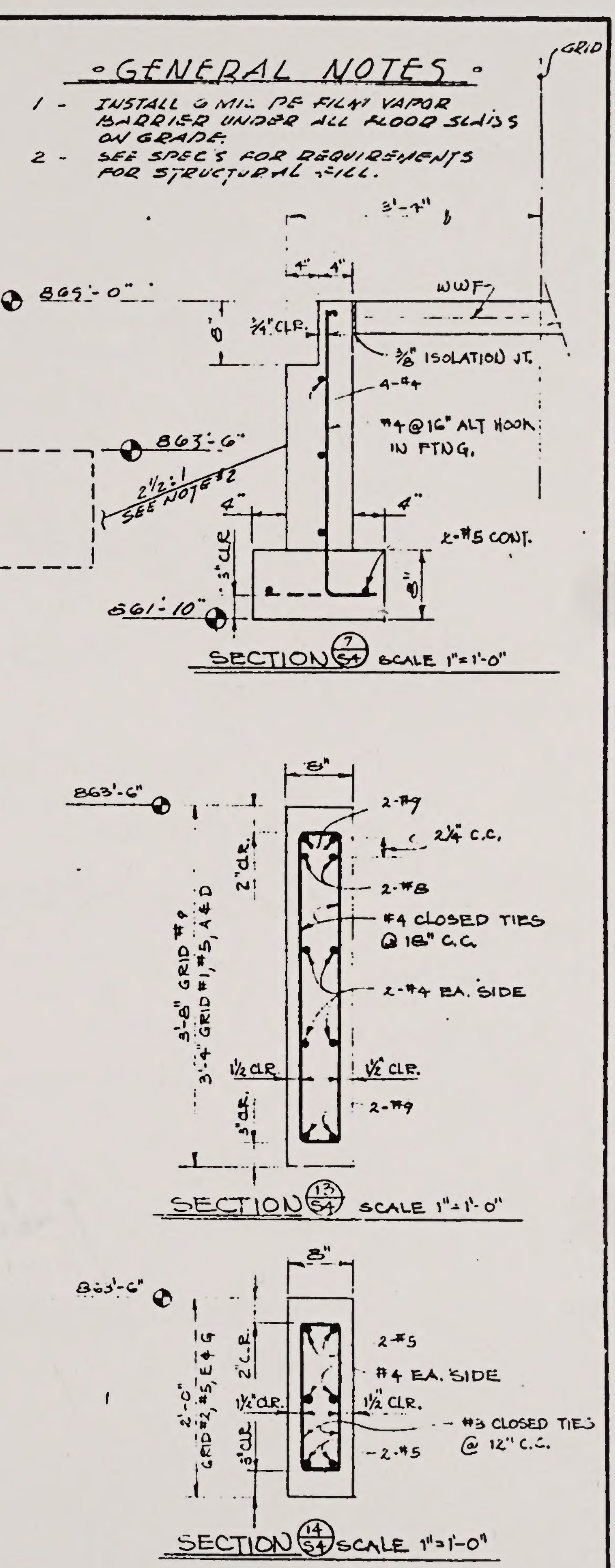
HIGH ROOF FRAMING PLAN AND DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED Wayne A. [illegible]
APPROVED Richard E. Engen

S 3

SCALE AS SHOWN
DATE JULY 1978
SHEET 25 OF 50
DRAWING NO. YA-400-915 1039





∘GENERAL NOTES∘

1 - INSTALL 6 MIL PE FILM VAPOR BARRIER UNDER ALL FLOOR SLABS ON GRADE.

2 - SEE SPEC'S FOR REQUIREMENTS FOR STRUCTURAL FILL.

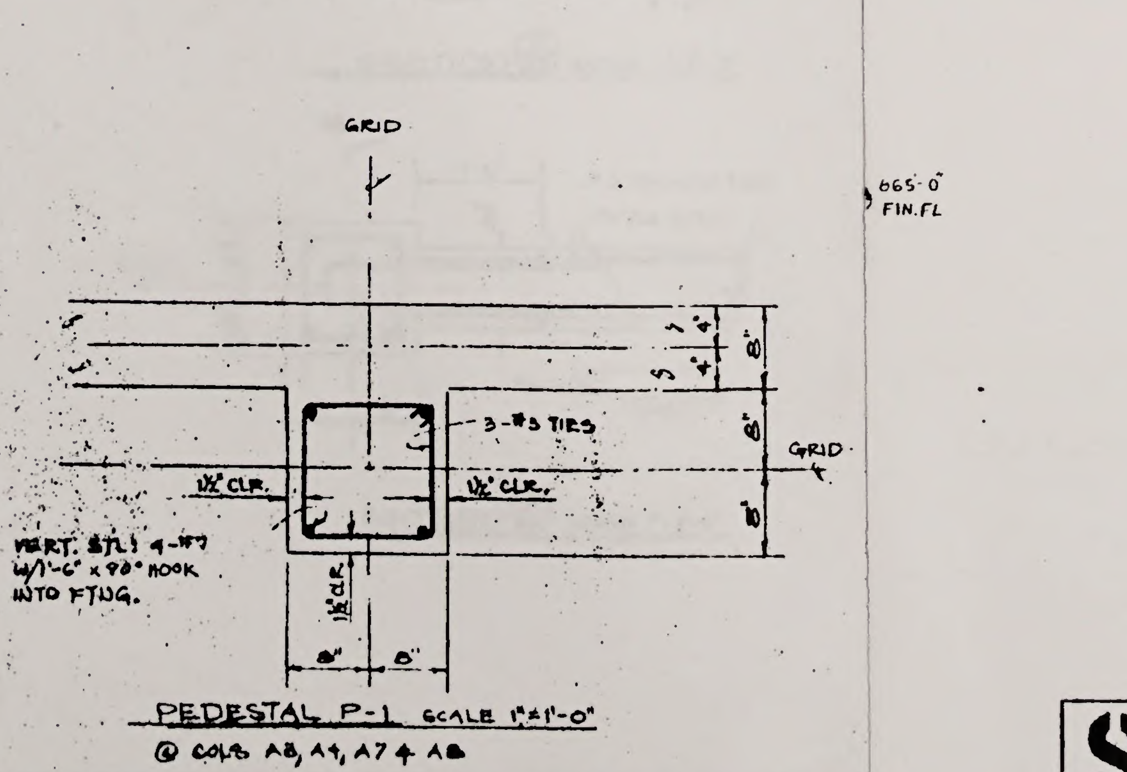


FIGURE NO. 17

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

FOUNDATION DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

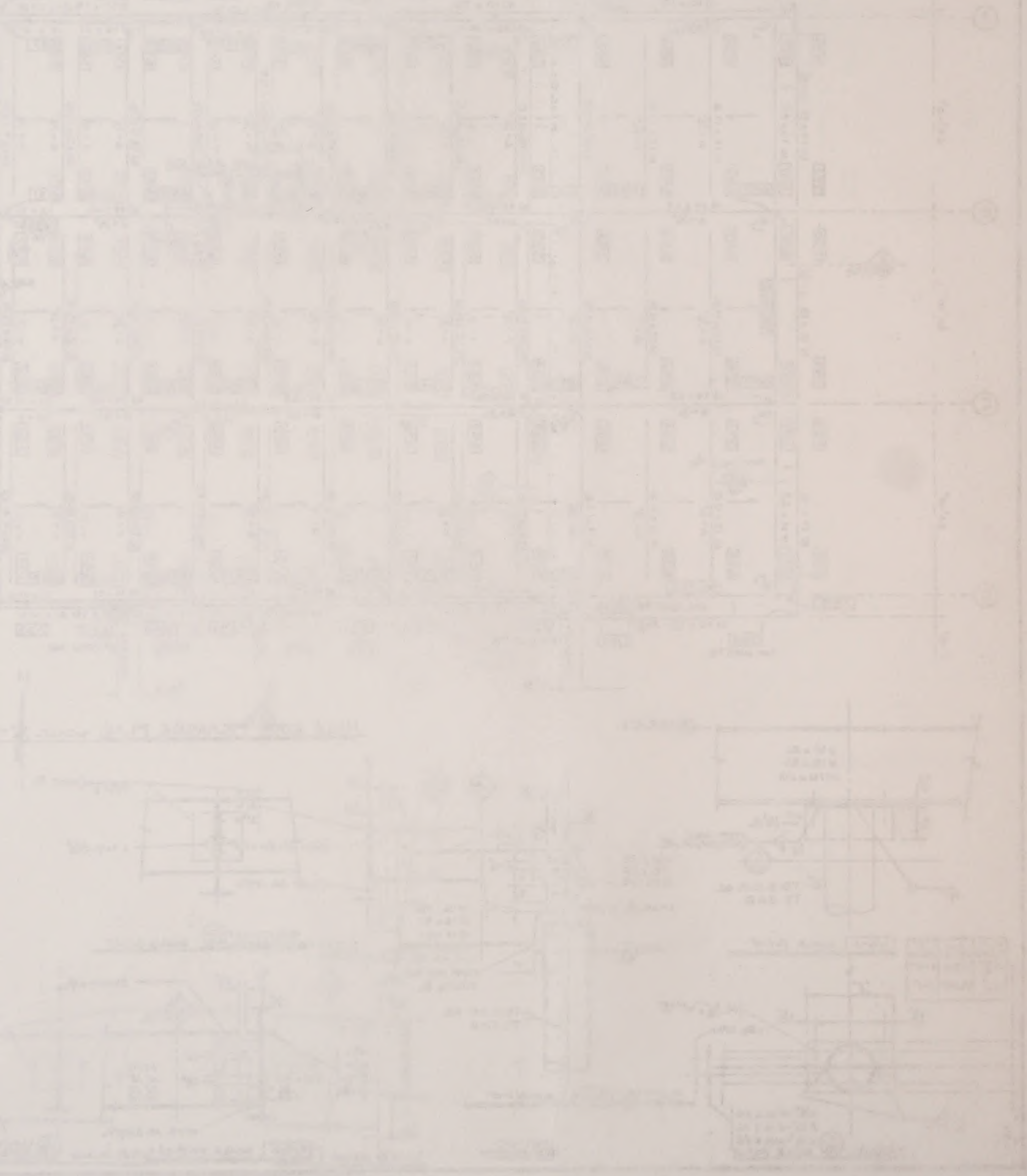
DESIGNED KAR	RECOMMENDED
DRAWN	RECOMMENDED
CHECKED	APPROVED

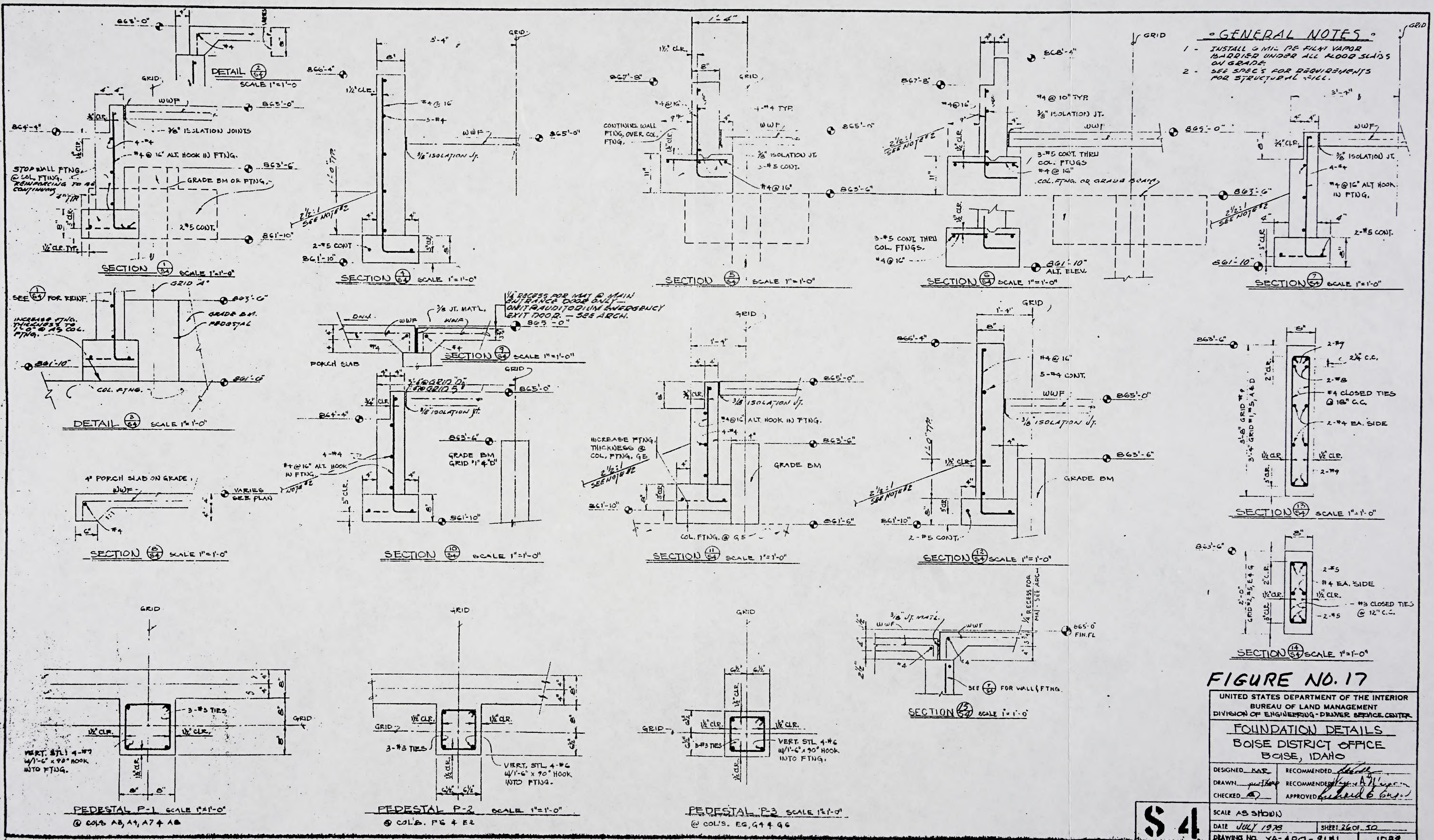
SCALE AS SHOWN

DATE JULY 1978 | SHEET 26 OF 50

DRAWING NO. YA-400-9181 | 1089

S 4




DETAIL 2/S4 SCALE 1"=1'-0"
SECTION 1/S4 SCALE 1"=1'-0"
WWF
3/8" ISOLATION JOINTS
4-#4
#4 @ 16" ALT. HOOK IN FTNG.
STOP WALL FTNG. @ COL. FTNG. REINFORCING TO BE CONTINUOUS
GRADE BM OR FTNG.
2-#5 CONT.
1½" CLR. TYP.
863'-0"
864'-4"
863'-6"
861'-10"
SECTION 4/S4 SCALE 1"=1'-0"
#4 @ 16
3-#4
3/8" ISOLATION JT.
2½:1 SEE NOTE #2
2-#5 CONT
866'-4"
865'-0"
SECTION 5/S4 SCALE 1"=1'-0"
CONTINUE WALL FTNG. OVER COL. FTNG.
4-#4 TYP.
3/8" ISOLATION JT.
3-#5 CONT.
#4 @ 16"
867'-8"
865'-0"
863'-6"
SECTION 6/S4 SCALE 1"=1'-0"
#4 @ 10" TYP.
3/8" ISOLATION JT.
3-#5 CONT. THRU COL. FTNGS
#4 @ 16"
COL. FTNG. OR GRADE BEAM
3-#5 CONT. THRU COL. FTNGS.
861'-10" ALT. ELEV.
868'-4"
SECTION 7/S4 SCALE 1"=1'-0"
3/8" ISOLATION JT.
4-#4
#4 @ 16" ALT HOOK IN FTNG.
2-#5 CONT.
DETAIL 3/S4 SCALE 1"=1'-0"
SEE 1/S4 FOR REINF.
INCREASE FTNG. THICKNESS TO 1'-0" @ AS COL. FTNG.
GRADE BM. PEDESTAL
COL. FTNG.
SECTION 9/S4 SCALE 1"=1'-0"
3/8 JT. MAT'L.
1/4" RECESS FOR MAT @ MAIN ENTRANCE DOOR ONLY - ONLY AUDITORIUM EMERGENCY EXIT DOOR. - SEE ARCH.
PORCH SLAB
SECTION 8/S4 SCALE 1"=1'-0"
4" PORCH SLAB ON GRADE
VARIES SEE PLAN
SECTION 10/S4 SCALE 1"=1'-0"
3/8" ISOLATION JT.
GRADE BM GRID "1" & "D"
4-#4
#4 @ 16" ALT. HOOK IN FTNG.
SECTION 11/S4 SCALE 1"=1'-0"
3/8" ISOLATION JT.
#4 @ 16" ALT. HOOK IN FTNG.
INCREASE FTNG. THICKNESS @ COL. FTNG. G5
GRADE BM
COL. FTNG. @ G5
SECTION 12/S4 SCALE 1"=1'-0"
#4 @ 16"
5-#4 CONT.
3/8" ISOLATION JT.
GRADE BM
2-#5 CONT.
SECTION 13/S4 SCALE 1"=1'-0"
2-#7
2¼" C.C.
2-#8
#4 CLOSED TIES @ 16" C.C.
2-#4 EA. SIDE
2-#9
SECTION 14/S4 SCALE 1"=1'-0"
2-#5
#4 EA. SIDE
#3 CLOSED TIES @ 12" C.C.
SECTION 15/S4 SCALE 1"=1'-0"
3/8" JT. MAT'L.
1/4" RECESS FOR MAT - SEE ARCH.
865'-0" FIN. FL.
SEE 7/S4 FOR WALL & FTNG.
PEDESTAL P-1 SCALE 1"=1'-0"
@ COLS AB, A4, A7 & A8
3-#3 TIES
VERT. STL. 4-#7 W/1'-6" x 90° HOOK INTO FTNG.
PEDESTAL P-2 SCALE 1"=1'-0"
@ COL'S. F6 & E2
3-#3 TIES
VERT. STL. 4-#6 W/1'-6" x 90° HOOK INTO FTNG.
PEDESTAL P-3 SCALE 1"=1'-0"
@ COL'S. EG, G4 & G6
VERT. STL. 4-#6 W/1'-6" x 90° HOOK INTO FTNG.
GRID

• GENERAL NOTES •

1 - INSTALL 6 MIL PE FILM VAPOR BARRIER UNDER ALL FLOOR SLABS ON GRADE.
2 - SEE SPEC'S FOR REQUIREMENTS FOR STRUCTURAL FILL.

FIGURE NO. 17

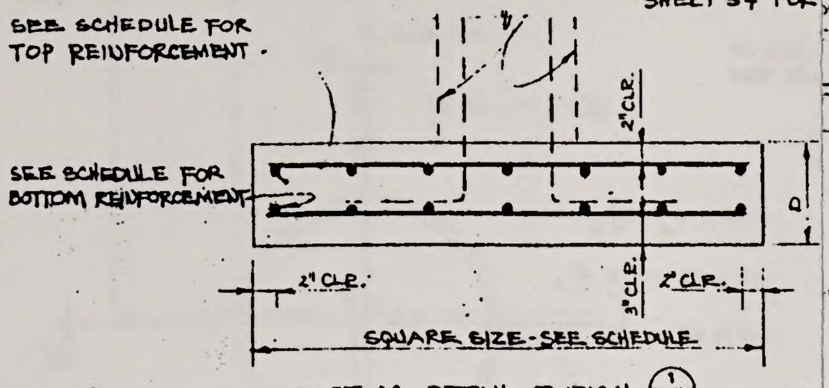
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

FOUNDATION DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

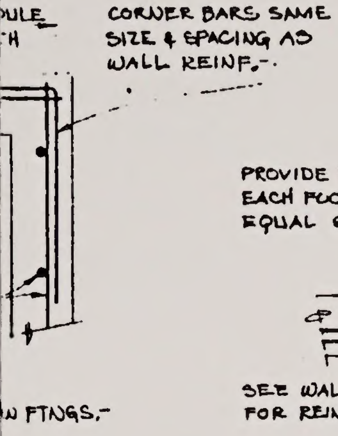
DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard B. Ensor

S 4

SCALE AS SHOWN
DATE JULY 1978
SHEET 26 OF 50
DRAWING NO. YA-400-9181 1084

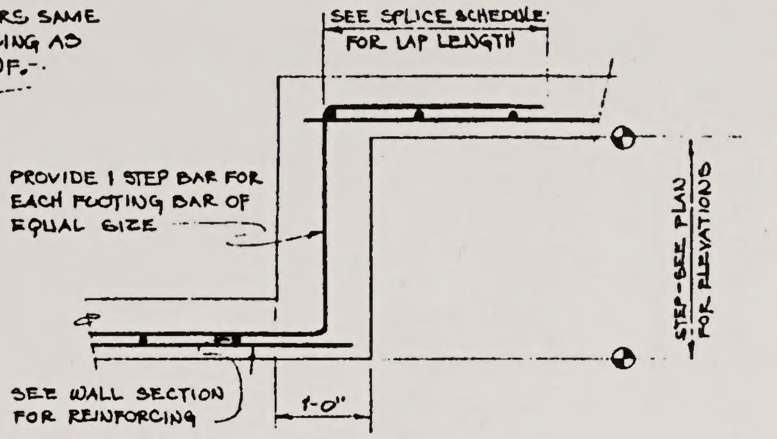

SEE PLAN FOR L
OF PEDESTALS -
SHEET S4 FOR
SEE SCHEDULE FOR TOP REINFORCEMENT.
SEE SCHEDULE FOR BOTTOM REINFORCEMENT
2" CLR.
D
2" CLR.
3" CLR.
2" CLR.
SQUARE SIZE - SEE SCHEDULE

FOOTING DETAIL, TYPICAL (1/S5) SCALE 1"=



N FTNGS.-

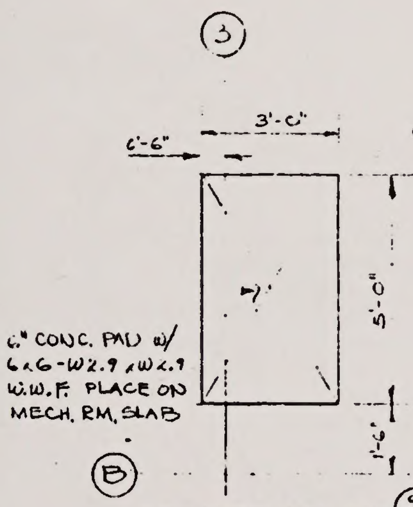
PICAL (3/S5) SCALE ¾"=1'-0"


SEE SPLICE SCHEDULE FOR LAP LENGTH
PROVIDE 1 STEP BAR FOR EACH FOOTING BAR OF EQUAL SIZE
STEP-SEE PLAN FOR ELEVATIONS
SEE WALL SECTION FOR REINFORCING
1'-0"

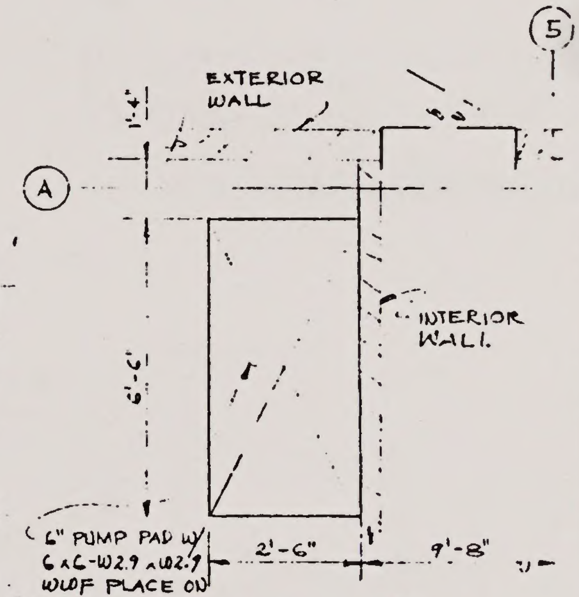
STEPPED FTNG., TYP. (4/S5) SCALE ¾"=1'-0"

FOOTING SCHEDULE

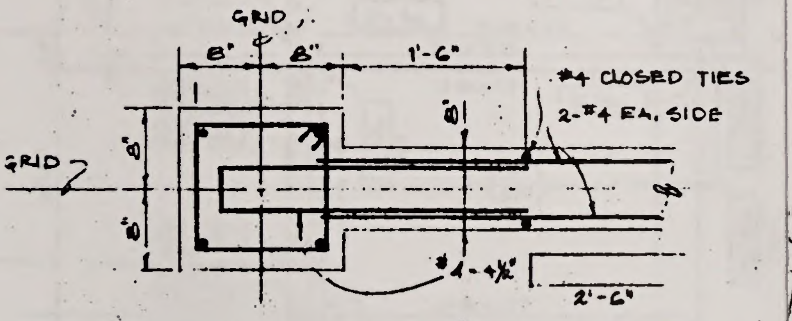
TYPE	SQUARE SIZE x D	REINFORCING
A	2'-6" x 2'-6" x 12"	4-#4 EA. WAY BOT
B	3'-0" x 3'-0" x 13"	4-#5 EA. WAY BOT
C	3'-9" x 3'-9" x 14"	4-#5 EA. WAY BOT
D	4'-2" x 4'-2" x 15"	5-#5 EA. WAY BOT
E	6'-0" x 6'-0" x 16"	6-#5 EA. WAY BOT 5-#4 EA. WAY TO
F	4'-8" x 4'-8" x 14"	4-#5 EA. WAY BOT 4-#4 EA. WAY TO
G	3'-0" x 3'-0" x 14"	4-#5 EA. WAY BOT 4-#4 EA. WAY TO
H	10'-0" x 10'-0" x 16"	8-#6 EA. WAY BOT 8-#5 EA. WAY TO
K	8'-0" x 8'-0" x 16"	9-#6 EA. WAY BO 6-#5 EA. WAY TO
M	7'-0" x 7'-0" x 16"	6-#6 EA. WAY BO 6-#5 EA. WAY TO
P	6'-0" x 6'-0" x 16"	6-#5 EA. WAY BO 5-#4 EA. WAY TO
Q	7'-0" x 7'-0" x 16"	7-#6 EA. WAY BO 7-#5 EA. WAY TO


(3)
(A)
(B)
3'-0"
6'-6"
5'-0"
1'-6"
6" CONC. PAD w/ 6x6-W2.9 x W2.9 W.W.F. PLACE ON MECH. RM. SLAB

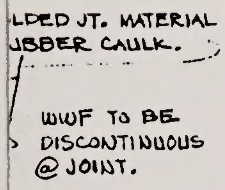
COMPRESSOR PAD (9/S5) SCALE ⅜"=1'-0"



PUMP PAD (10/S5) SCALE ⅜"=1'-0"



SECTION (5/S5) SCALE 1"=1'-0"

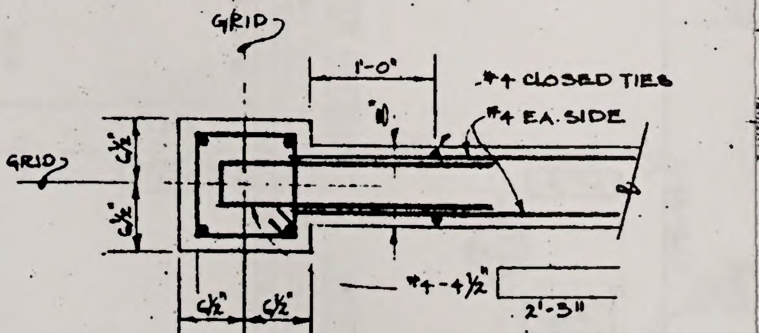


SPLICE LENGTH TABLE

TYP. UNLESS NOTED

BAR SIZE	TOP* BARS	ALL OTHER BARS
4	19"	14"
5	24"	17"
6	31"	22"
7	42"	30"
8	55"	40"
9	70"	50"
10	89"	64"
11	109"	78"

* TOP BARS ARE HORZONTAL W/12" OR MORE CONCRETE PLACE BELOW THE BAR.



SECTION (6/S5) SCALE 1"=1'-0"

(3/
CALE

FOR
S @

FIGURE NO. 18

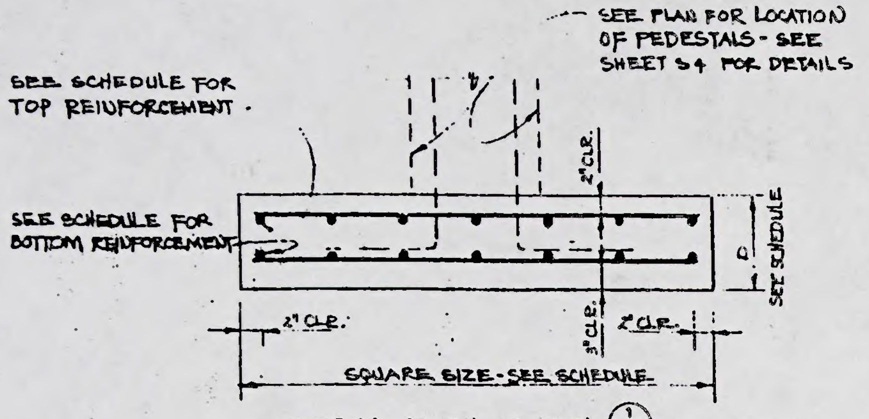
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

CONCRETE DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR	RECOMMENDED
DRAWN	RECOMMENDED
CHECKED	APPROVED Richard E. [illegible]

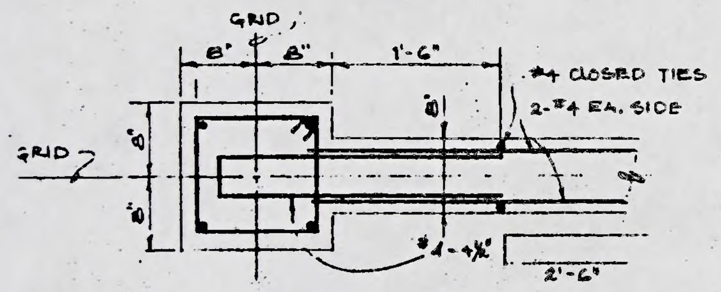
S 5

SCALE AS SHOWN
DATE July 1978 | SHEET 27 OF 50
DRAWING NO. YA-400-1151 | 1331

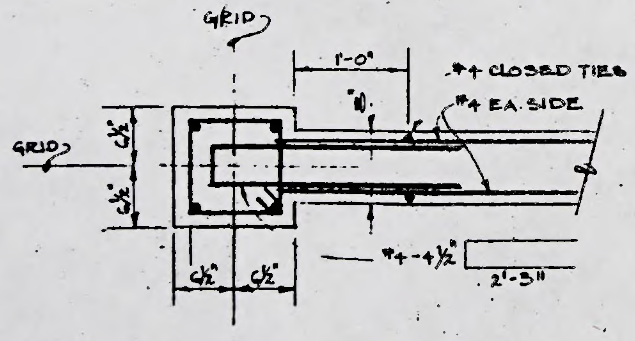

SEE PLAN FOR LOCATION OF PEDESTALS - SEE SHEET S4 FOR DETAILS
SEE SCHEDULE FOR TOP REINFORCEMENT
SEE SCHEDULE FOR BOTTOM REINFORCEMENT
2" CLR.
2" CLR.
3" CLR.
2" CLR.
D
SEE SCHEDULE
SQUARE SIZE - SEE SCHEDULE

FOOTING DETAIL, TYPICAL (1/S5) SCALE 1"=1'-0"

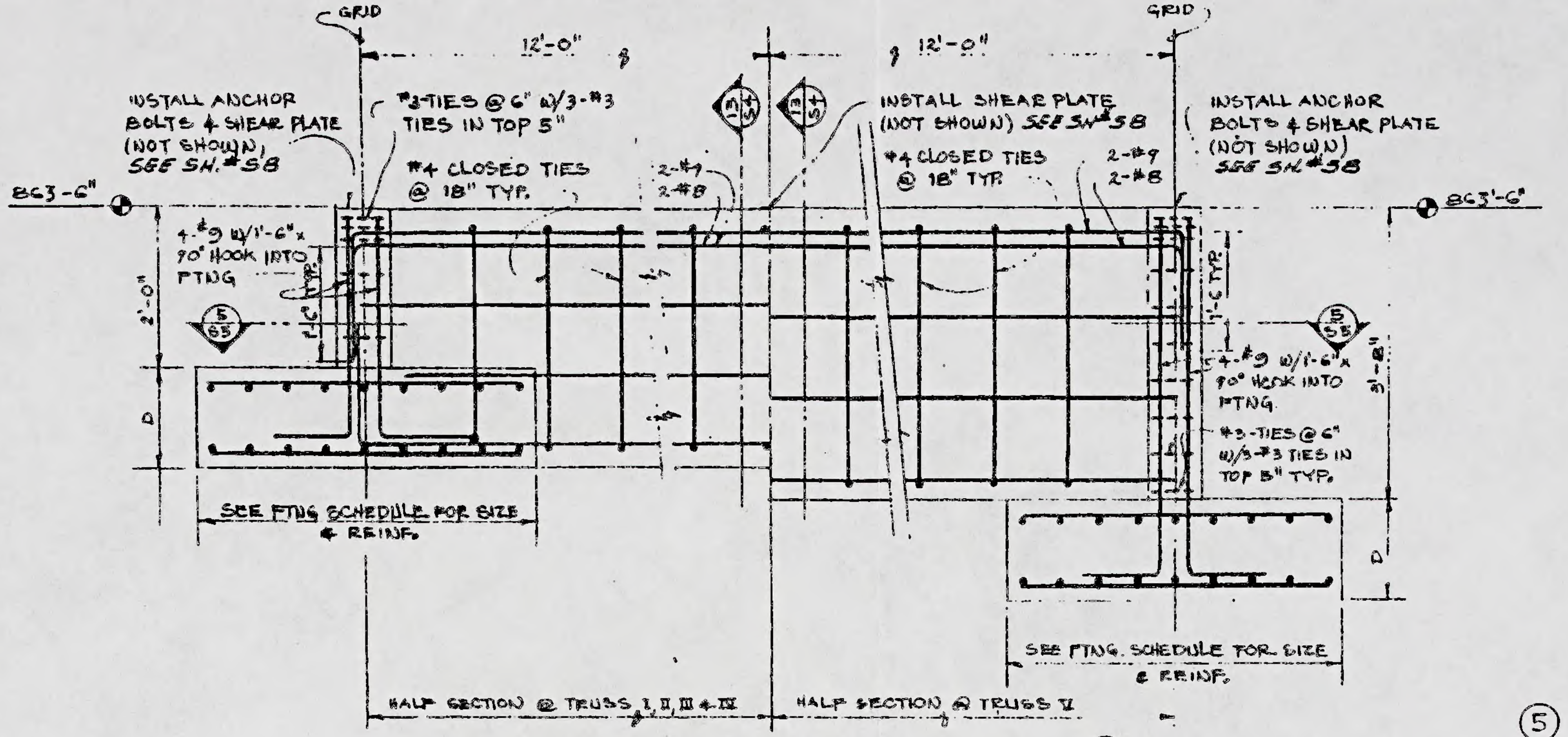
FOOTING SCHEDULE		
TYPE	SQUARE SIZE x D	REINFORCING
A	2'-6" x 2'-6" x 12"	4-#4 EA. WAY BOTT.
B	3'-0" x 3'-0" x 13"	4-#5 EA. WAY BOTT.
C	3'-9" x 3'-9" x 14"	4-#5 EA. WAY BOTT.
D	4'-2" x 4'-2" x 15"	5-#5 EA. WAY BOTT.
E	6'-0" x 6'-0" x 16"	5-#5 EA. WAY BOTT. 5-#4 EA. WAY TOP
F	4'-8" x 4'-8" x 14"	4-#5 EA. WAY BOTT. 4-#4 EA. WAY TOP
G	3'-0" x 3'-0" x 14"	4-#5 EA. WAY BOTT. 4-#4 EA. WAY TOP
H	10'-0" x 10'-0" x 16"	8-#6 EA. WAY BOTT. 8-#5 EA. WAY TOP
K	8'-0" x 8'-0" x 16"	9-#6 EA. WAY BOTT. 6-#5 EA. WAY TOP
M	7'-0" x 7'-0" x 16"	6-#6 EA. WAY BOTT. 6-#5 EA. WAY TOP
P	6'-0" x 6'-0" x 16"	6-#5 EA. WAY BOTT. 5-#4 EA. WAY TOP
Q	7'-0" x 7'-0" x 16"	7-#6 EA. WAY BOTT. 7-#5 EA. WAY TOP



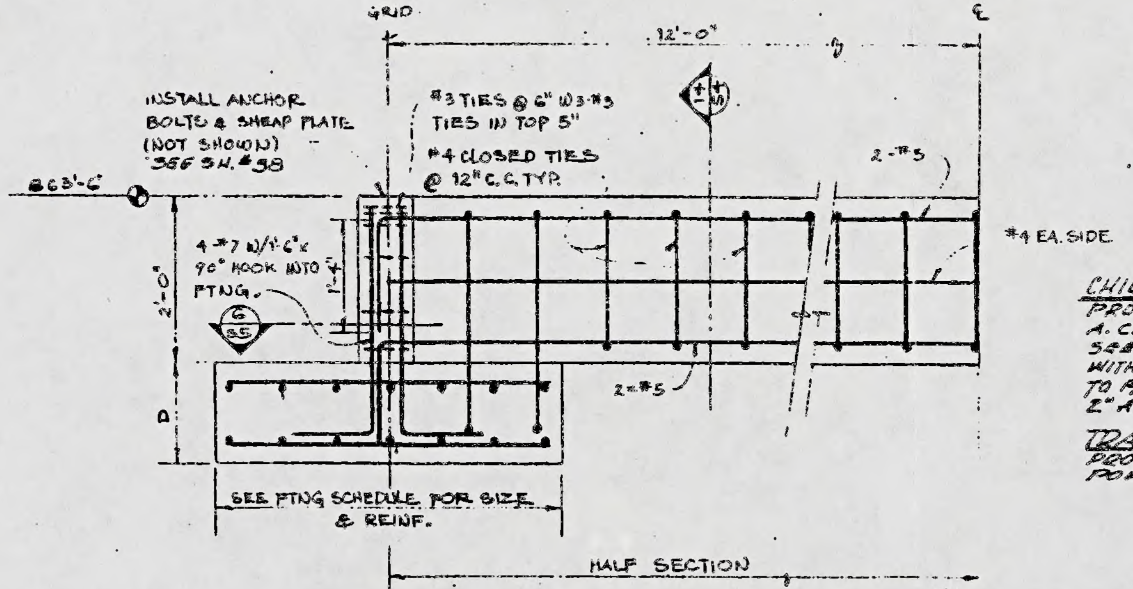
SECTION (5/S5) SCALE 1½"=1'-0"



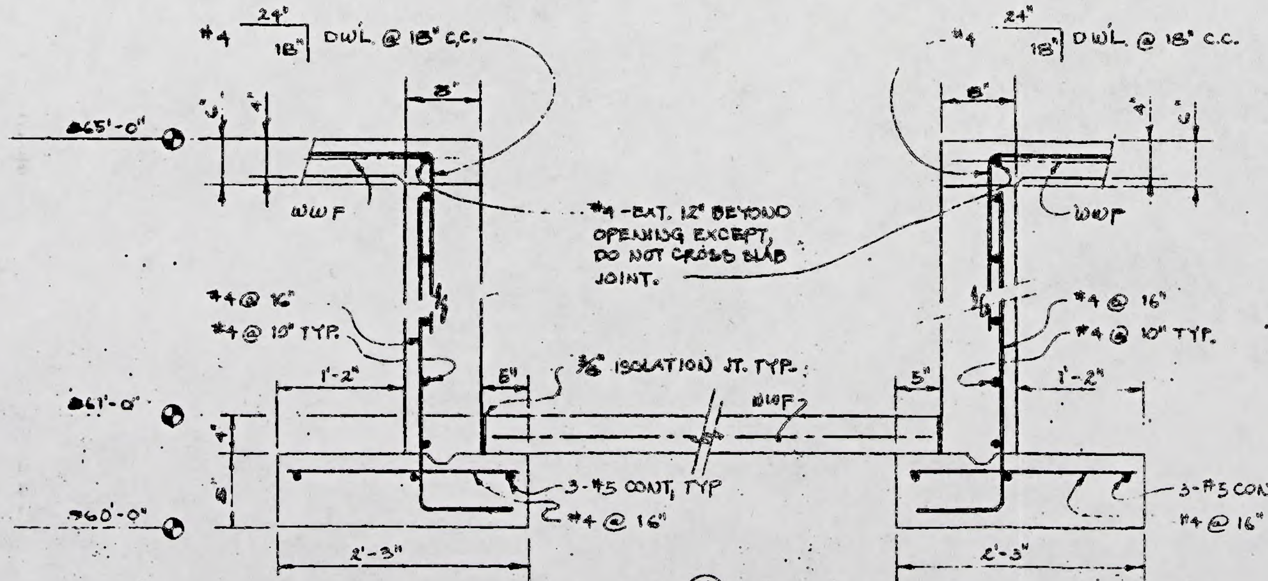
SECTION (6/S5) SCALE 1½"=1'-0"


GRID
12'-0"
12'-0"
GRID
INSTALL ANCHOR BOLTS & SHEAR PLATE (NOT SHOWN), SEE SH. #S8
#3-TIES @ 6" W/3-#3 TIES IN TOP 5"
#4 CLOSED TIES @ 18" TYP.
2-#9
2-#8
13/S4
13/S4
INSTALL SHEAR PLATE (NOT SHOWN) SEE SH.#S8
#4 CLOSED TIES @ 18" TYP.
2-#9
2-#8
INSTALL ANCHOR BOLTS & SHEAR PLATE (NOT SHOWN) SEE SH.#S8
863-6"
863'-6"
4-#9 W/1'-6" x 90° HOOK INTO FTNG
2'-0"
1'-6" TYP.
5/S5
D
1'-6" TYP.
5/S5
4-#9 W/1'-6" x 90° HOOK INTO FTNG.
#3-TIES @ 6" W/3-#3 TIES IN TOP 5" TYP.
3'-8"
D
SEE FTNG SCHEDULE FOR SIZE & REINF.
SEE FTNG. SCHEDULE FOR SIZE & REINF.
HALF SECTION @ TRUSS I, II, III & IV
HALF SECTION @ TRUSS V

K-TRUSS FOOTINGS & GRADE BM @ TRUSSES I, II, III, IV & V (2/S5) SCALE ¼"=1'-0"


GRID
12'-0"
℄
INSTALL ANCHOR BOLTS & SHEAR PLATE (NOT SHOWN) SEE SH. #S8
#3 TIES @ 6" W3-#3 TIES IN TOP 5"
#4 CLOSED TIES @ 12" C.C. TYP.
14/S4
2-#5
#4 EA. SIDE
863'-6"
4-#7 W/1'-6" x 90° HOOK INTO FTNG.
2'-0"
6/S5
D
2-#5
SEE FTNG SCHEDULE FOR SIZE & REINF.
HALF SECTION

K-TRUSS FOOTINGS & GRADE BM @ TRUSSES VI, VII, VIII & IX (7/S5) SCALE ¼"=1'-0"



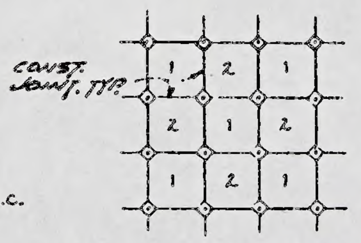
SECTION (11/S5) SCALE 1"=1'-0"

CHILLED PAD

PROVIDE 22'x10'x 6" SLAB FOR A.C. CHILLER NORTH OF BUILDING. SEE SH. #M-9 FOR LOCATION. REINFORCE WITH 6x6-W2.9xW2.9 W.W.F. SLAB TO BE LEVEL AND NOT LESS THAN 2" ABOVE FINAL YARD GRADE.

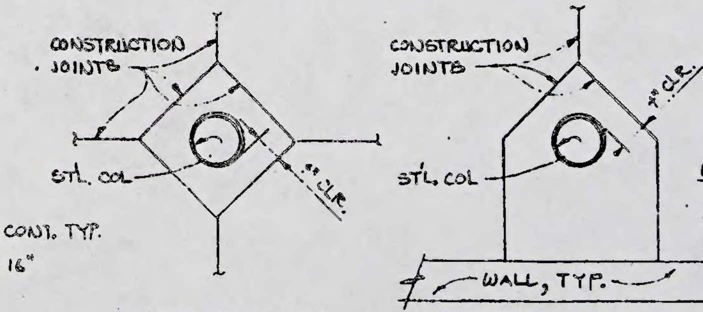
TRANSFORMER PAD

PROVIDE TRANSFORMER PAD TO POWER CO. SPEC.S.



NOTE - PLACE SLAB ON GRADE IN CHECKERBOARD PATTERN
1 - FIRST PLACEMENT
2 - SECOND PLACEMENT

PLACING DIAGRAM (12/S5)



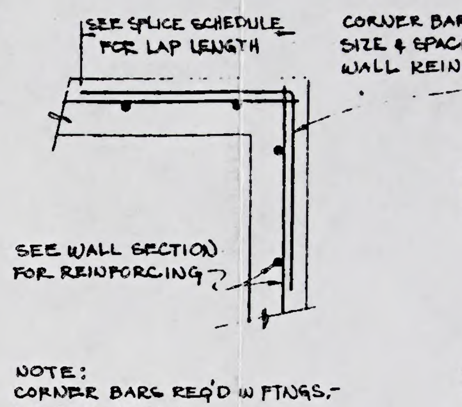
@ INTERIOR COLUMN

@ EXTERIOR COLUMN

NOTE

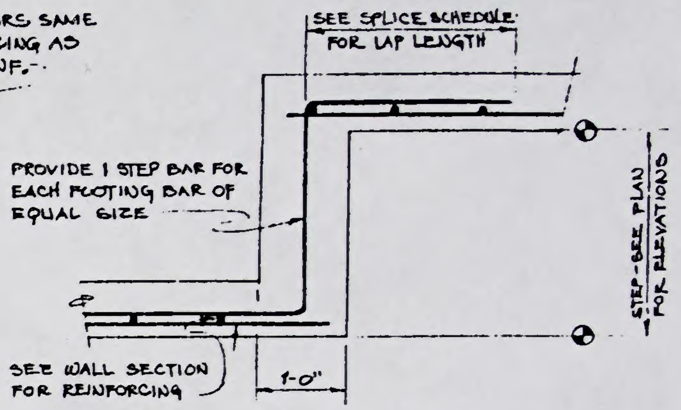
SEE PLAN FOR VARIATIONS @ CORNERS.

COLUMN ISOLATION JOINTS NO SCALE (14/S5)

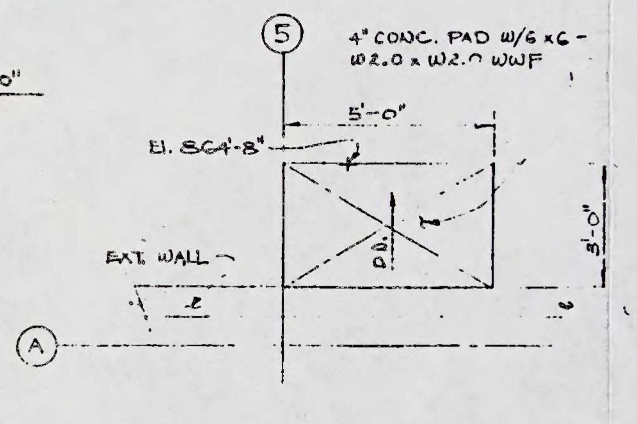

SEE SPLICE SCHEDULE FOR LAP LENGTH
CORNER BARS SAME SIZE & SPACING AS WALL REINF.
SEE WALL SECTION FOR REINFORCING

NOTE:
CORNER BARS REQ'D IN FTNGS, SIMILAR DETAIL.

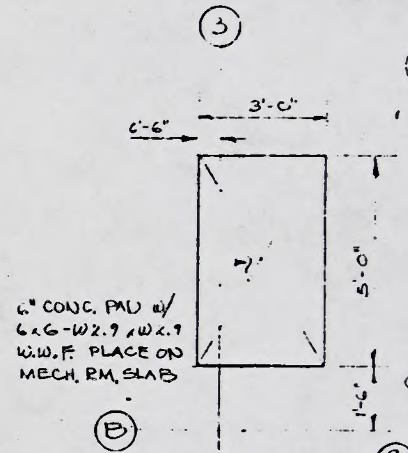
WALL CORNER, TYPICAL (3/S5) SCALE ¾"=1'-0"


SEE SPLICE SCHEDULE FOR LAP LENGTH
PROVIDE 1 STEP BAR FOR EACH FOOTING BAR OF EQUAL SIZE
STEP - SEE PLAN FOR ELEVATIONS
SEE WALL SECTION FOR REINFORCING
1'-0"

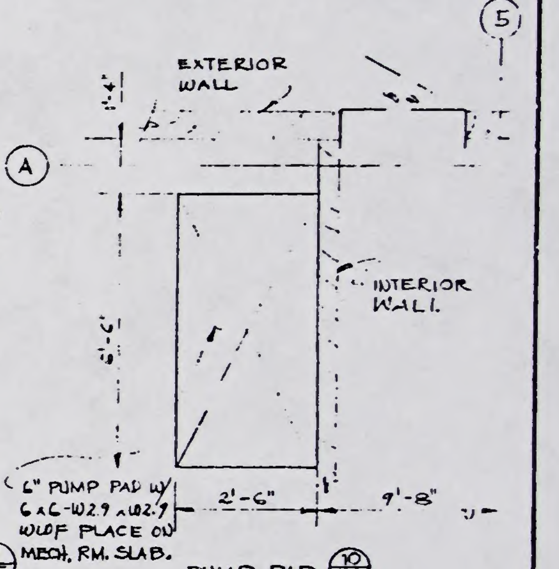
STEPPED FTNG, TYP (4/S5) SCALE ¾"=1'-0"



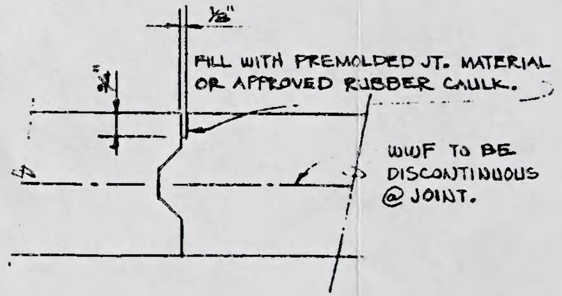
METER PAD (8/S5) SCALE ⅜"=1'-0"


3
3'-0"
6'-6"
5'-0"
6" CONC. PAD W/ 6x6-W2.9 x W2.9 W.W.F. PLACE ON MECH. RM. SLAB
B

COMPRESSOR PAD (9/S5) SCALE ⅜"=1'-0"



PUMP PAD (10/S5) SCALE ⅜"=1'-0"


½"
FILL WITH PREMOLDED JT. MATERIAL OR APPROVED RUBBER CAULK.
WWF TO BE DISCONTINUOUS @ JOINT.

SLAB CONST. JOINT-TYP. (13/S5) NO SCALE

SPLICE LENGTH TABLE		
TYP. UNLESS NOTED		
BAR SIZE	TOP* BARS	ALL OTHER BARS
4	19"	14"
5	24"	17"
6	31"	22"
7	42"	30"
8	55"	40"
9	70"	50"
10	89"	64"
11	109"	78"

* TOP BARS ARE HORZONTAL W/12" OR MORE CONCRETE PLACE BELOW THE BAR.

FIGURE NO. 18

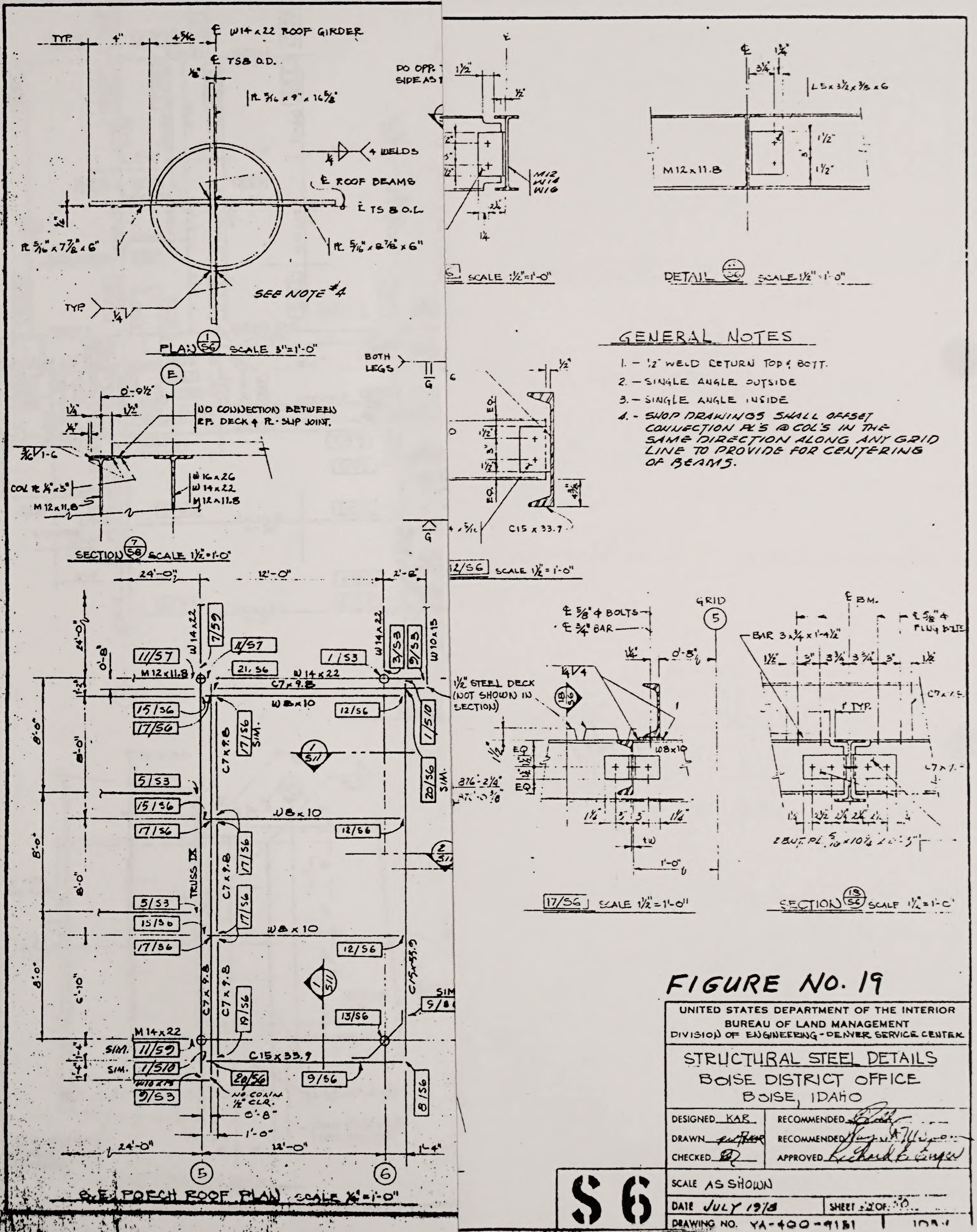
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

CONCRETE DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

S5

SCALE AS SHOWN
DATE July 1978
SHEET 27 OF 50
DRAWING NO. YA-400-1151 | 1331



GENERAL NOTES

1. – 1/2" WELD RETURN TOP & BOTT.
2. – SINGLE ANGLE OUTSIDE
3. – SINGLE ANGLE INSIDE
4. – SHOP DRAWINGS SHALL OFFSET CONNECTION PL'S @ COL'S IN THE SAME DIRECTION ALONG ANY GRID LINE TO PROVIDE FOR CENTERING OF BEAMS.

FIGURE NO. 19

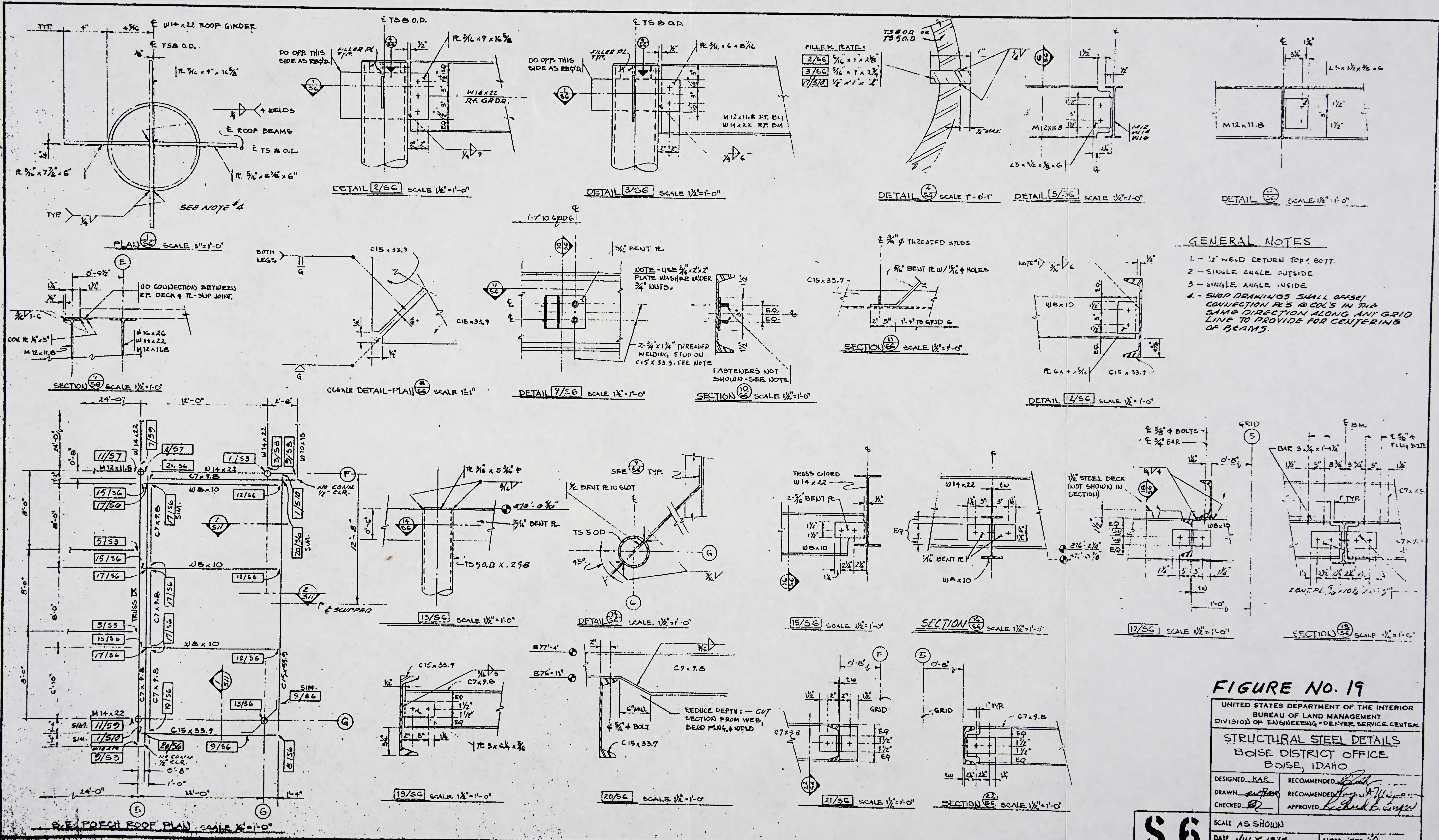
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

STRUCTURAL STEEL DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Engen

S 6

SCALE AS SHOWN
DATE JULY 1978
SHEET 2 OF 10
DRAWING NO. YA-400-9181



GENERAL NOTES

1. – ½" WELD RETURN TOP & BOTT.
2. – SINGLE ANGLE OUTSIDE
3. – SINGLE ANGLE INSIDE
4. – SHOP DRAWINGS SHALL OFFSET CONNECTION PL'S @ COL'S IN THE SAME DIRECTION ALONG ANY GRID LINE TO PROVIDE FOR CENTERING OF BEAMS.

FIGURE NO. 19

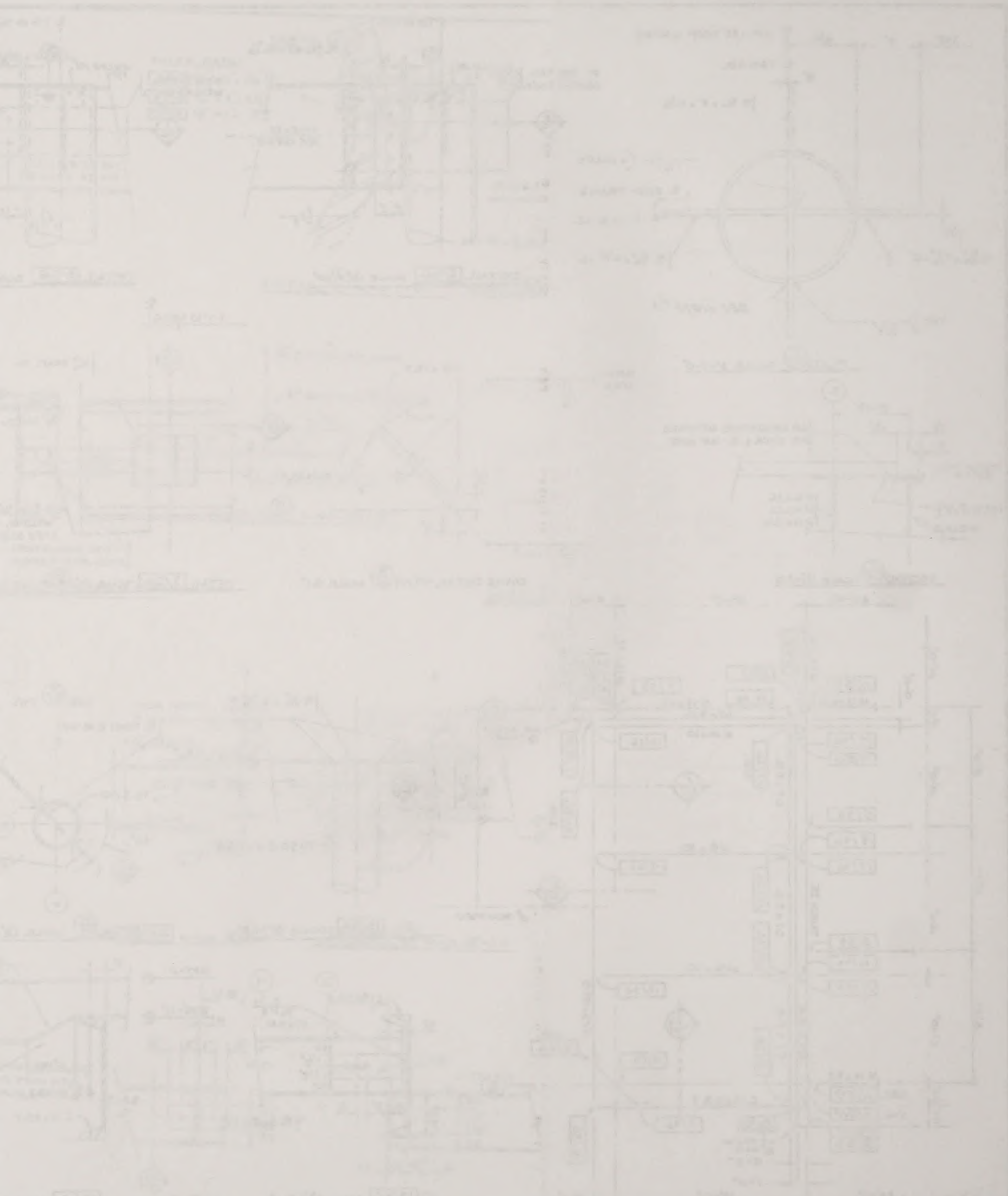
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING-DENVER SERVICE CENTER

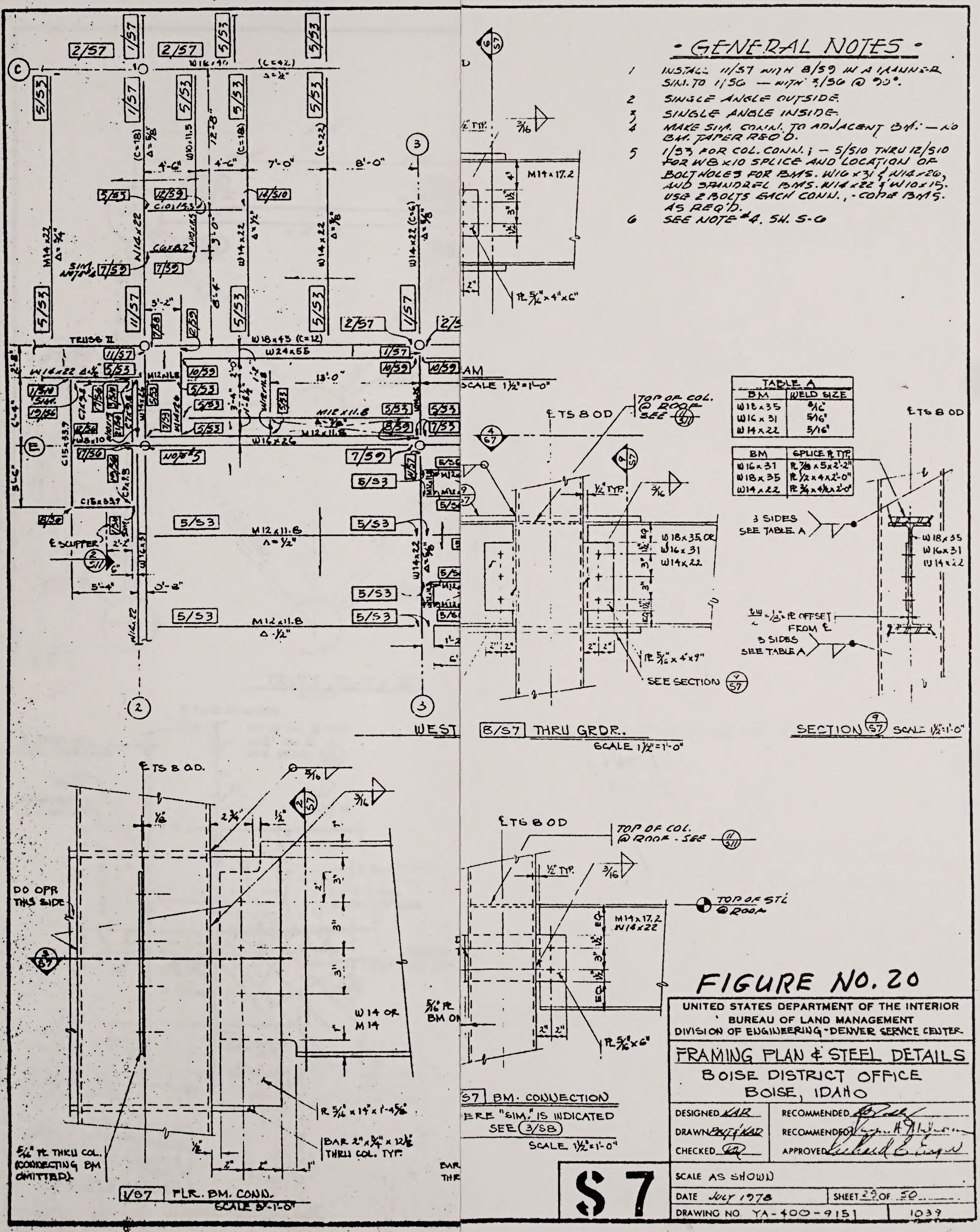
STRUCTURAL STEEL DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Engen

S 6

SCALE AS SHOWN
DATE JULY 1978
SHEET 2 OF 30
DRAWING NO. YA-400-9151





• GENERAL NOTES •

1. INSTALL 11/57 WITH 8/59 IN A MANNER SIM. TO 1/56 — WITH 3/56 @ 90°.
2. SINGLE ANGLE OUTSIDE.
3. SINGLE ANGLE INSIDE.
4. MAKE SIM. CONN. TO ADJACENT BM. — NO BM. TAPER REQ'D.
5. 1/53 FOR COL. CONN.; — 5/510 THRU 12/510 FOR W8x10 SPLICE AND LOCATION OF BOLTHOLES FOR BMS. W16x31 & W14x26, AND SPANDREL BMS. W14x22 & W10x15. USE 2 BOLTS EACH CONN., - COPE BMS. AS REQ'D.
6. SEE NOTE #4. SH. S-6

TABLE A

BM	WELD SIZE
W18x35	3/16"
W16x31	5/16"
W14x22	5/16"

BM	SPLICE ℞ TYP.
W16x31	℞ ⅞x5x2'-2"
W18x35	℞ ½x4x2'-0"
W14x22	℞ ¾x4½x2'-0"

FIGURE NO. 20

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

FRAMING PLAN & STEEL DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

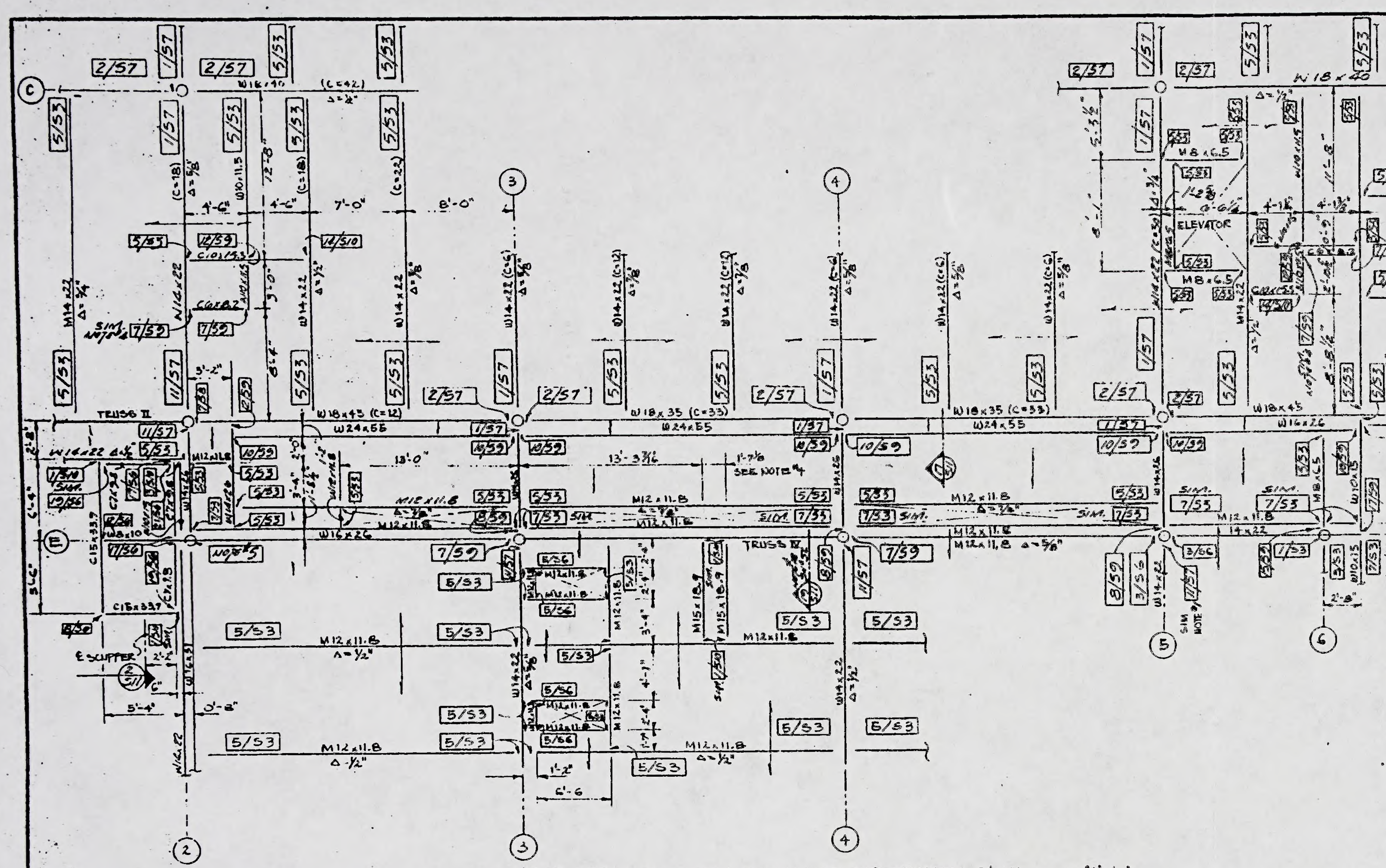
DESIGNED KAR	RECOMMENDED
DRAWN BKT & KAR	RECOMMENDED
CHECKED	APPROVED Richard E. [illegible]

S 7

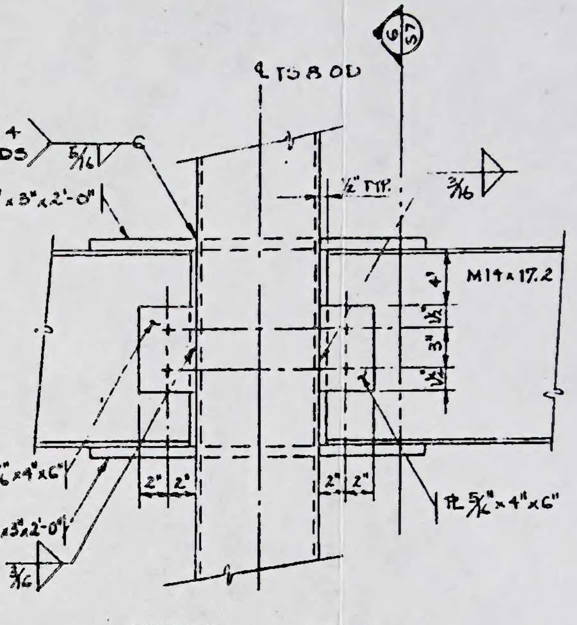
SCALE AS SHOWN

DATE JULY 1978 SHEET 29 OF 50

DRAWING NO. YA-400-9151 1039



WEST PORCH, STAIRWELL & MAIN CORRIDOR FRAMING PLAN SCALE 3/16"=1'-0"



7/S7 THRU BEAM
SCALE 1½"=1'-0"

• GENERAL NOTES •

1 INSTALL 11/S7 WITH 8/S9 IN A MANNER SIM. TO 1/S6 — WITH 3/S6 @ 90°.

2 SINGLE ANGLE OUTSIDE.

3 SINGLE ANGLE INSIDE.

4 MAKE SIM. CONN. TO ADJACENT BM. — NO BM. TAPER REQ'D.

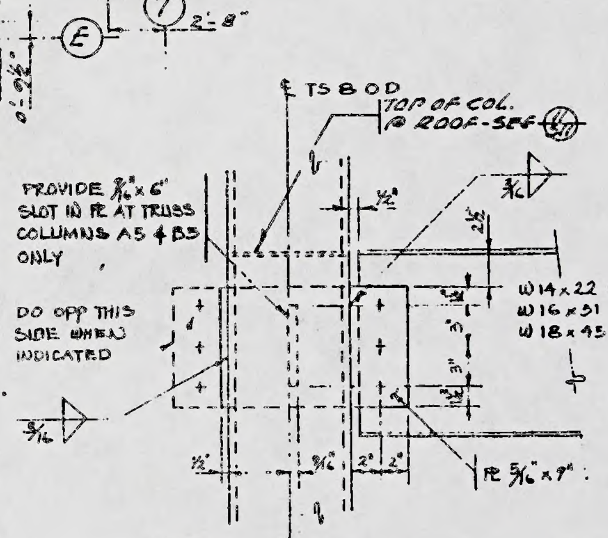
5 1/S3 FOR COL. CONN.; — 5/S10 THRU 12/S10 FOR W8x10 SPLICE AND LOCATION OF BOLTHOLES FOR BMS. W16x31 & W14x26, AND SPANDREL BMS. W14x22 & W10x15. USE 2 BOLTS EACH CONN., - COPE BMS. AS REQ'D.

6 SEE NOTE #4, SH. S-6

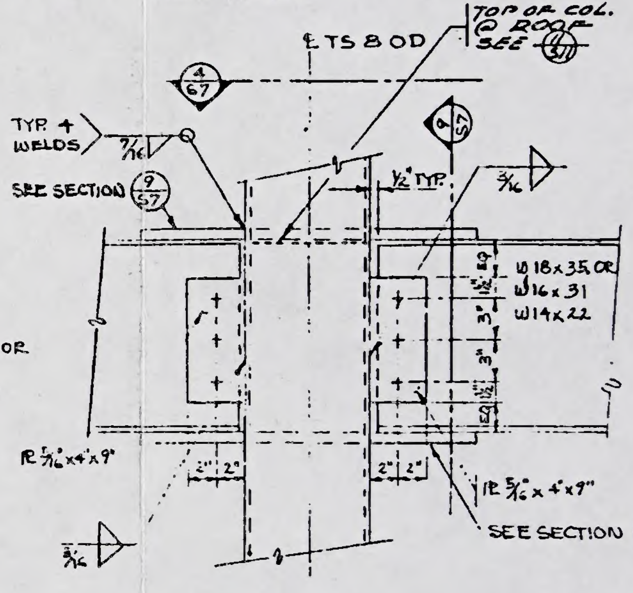
TABLE A

BM	WELD SIZE
W18x35	5/16"
W16x31	5/16"
W14x22	5/16"

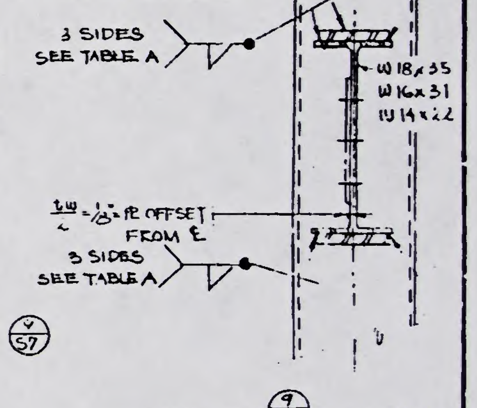
BM	SPLICE PL TYP.
W16x31	PL 7/8 x 5 x 2'-2"
W18x35	PL 1/2 x 4 x 2'-0"
W14x22	PL 3/4 x 4½ x 2'-0"


℄ TS 8 OD
TOP OF COL. @ ROOF - SEE 1/S11
PROVIDE 9/16"x6" SLOT IN PL AT TRUSS COLUMNS A5 & B5 ONLY
DO OPP. THIS SIDE WHEN INDICATED
W14x22 OR W16x31 W18x45
PL 5/16"x4"x9"
PL 5/16"x9"
3/16
1/2"
2" 2"

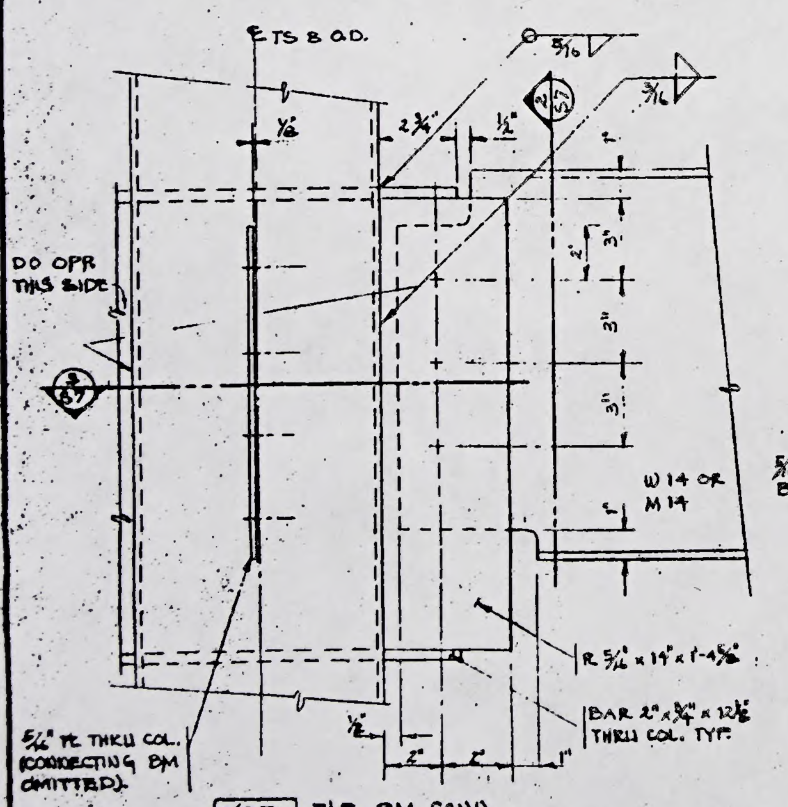
5/S7 GRDR. CONN.
SCALE 1½"=1'-0"



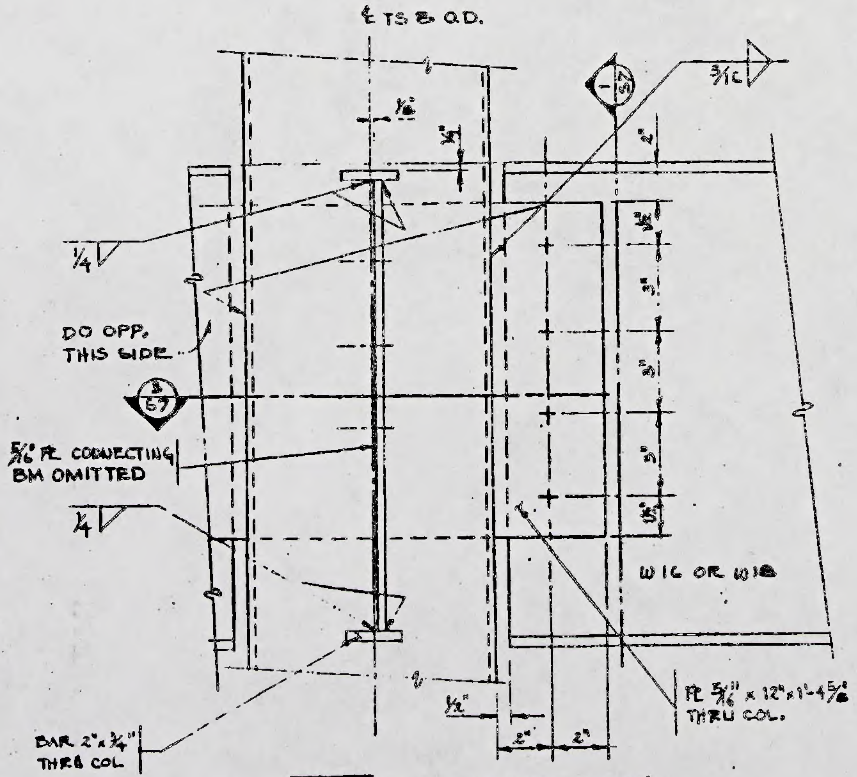
8/S7 THRU GRDR.
SCALE 1½"=1'-0"



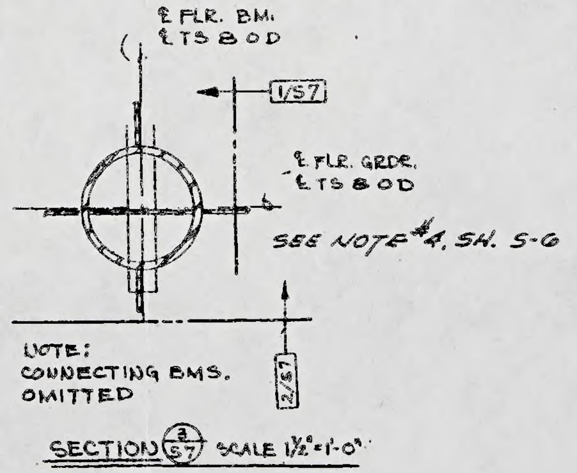
SECTION 9/S7 SCALE 1½"=1'-0"


℄ TS 8 O.D.
5/16
3/16
2¾
1/2"
DO OPP. THIS SIDE
W14 OR M14
PL 5/16"x 14"x 1'-4½"
BAR 2"x 3/4"x 12½" THRU COL. TYP.
5/16" PL THRU COL. (CONNECTING BM OMITTED)

1/S7 FLR. BM. CONN.
SCALE 3"=1'-0"

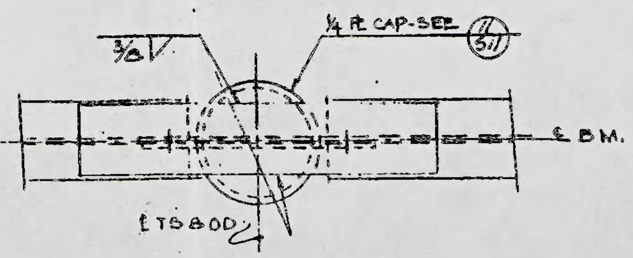


2/S7 FLR. GRDR. CONN.
SCALE 3"=1'-0"

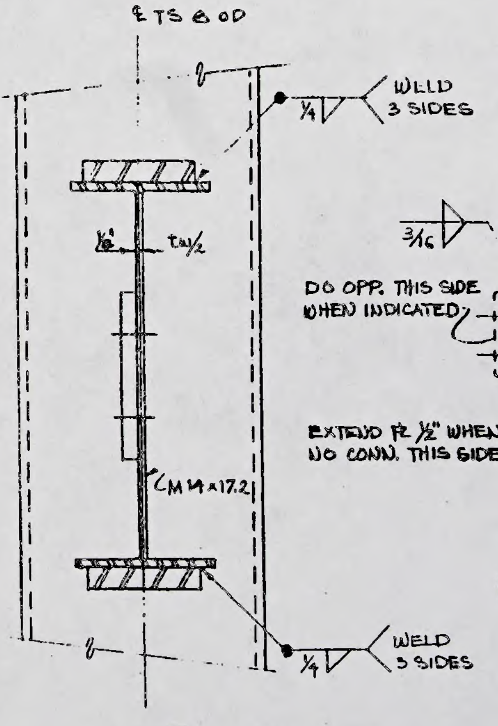


NOTE: CONNECTING BMS. OMITTED

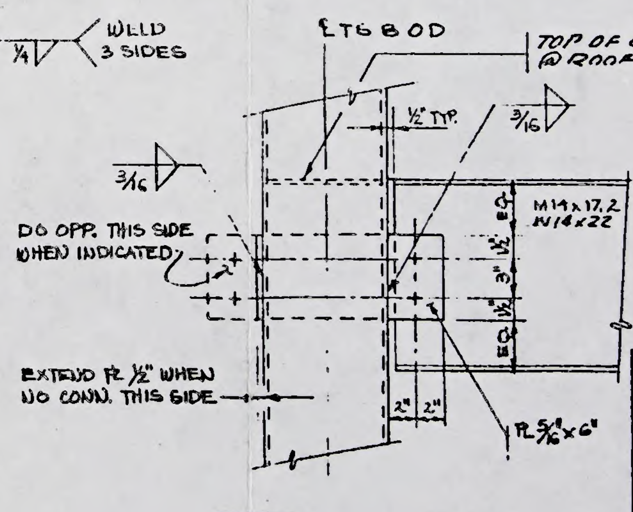
SECTION 3/S7 SCALE 1½"=1'-0"



PLAN @ ROOF 4/S7 SCALE 1½"=1'-0"



SECTION 6/S7 SCALE 3"=1'-0"


℄ TS 8 OD
TOP OF COL. @ ROOF - SEE 1/S11
1/2" TYP.
3/16
3/16
DO OPP. THIS SIDE WHEN INDICATED
EXTEND PL 1/2" WHEN NO CONN. THIS SIDE
M14x17.2 W14x22
PL 5/16"x6"
2" 2"
TOP OF STL @ ROOF

11/S7 BM. CONNECTION
WHERE "SIM." IS INDICATED SEE 3/S8
SCALE 1½"=1'-0"

FIGURE NO. 20

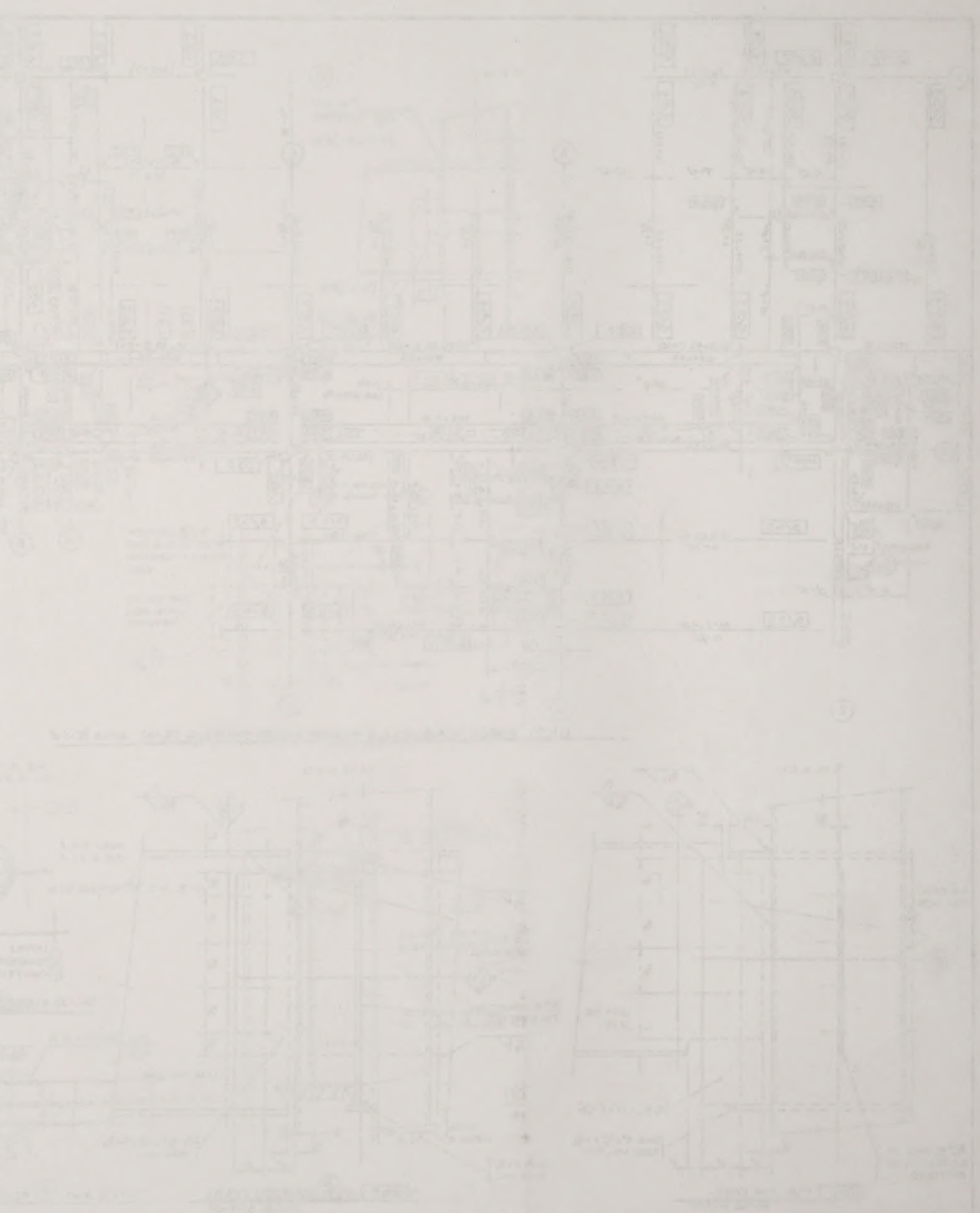
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

FRAMING PLAN & STEEL DETAILS
BOISE DISTRICT OFFICE
BOISE, IDAHO

DESIGNED KAR	RECOMMENDED
DRAWN PHT & KAR	RECOMMENDED
CHECKED	APPROVED

S7

SCALE AS SHOWN
DATE JULY 1978 SHEET 29 OF 50
DRAWING NO. YA-400-9151 1039



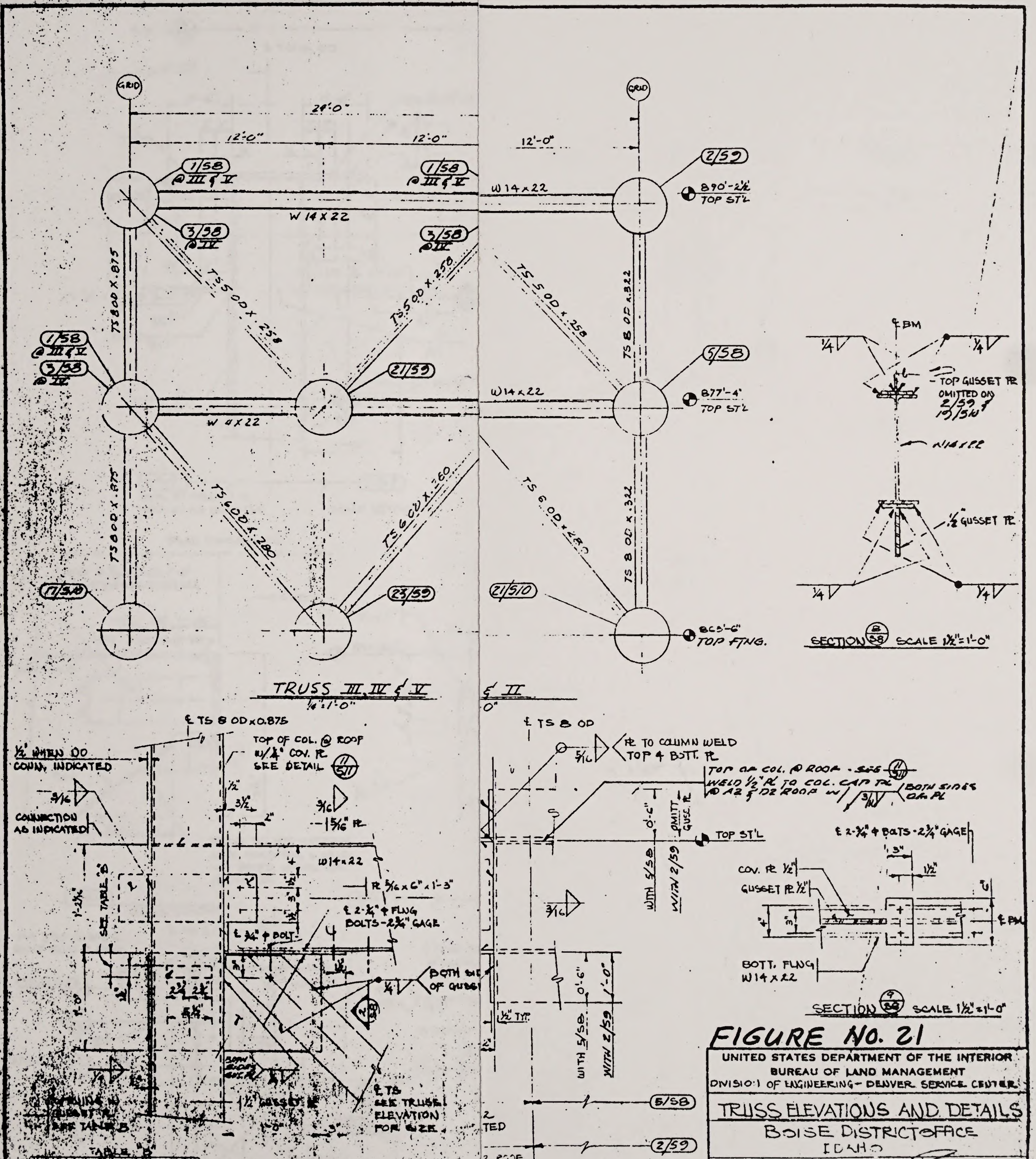


FIGURE NO. 21

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING – DENVER SERVICE CENTER

TRUSS ELEVATIONS AND DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard

S 8

SCALE AS SHOWN
DATE JULY 1978
SHEET 30 OF 50
DRAWING NO. YA-400-9151
1087

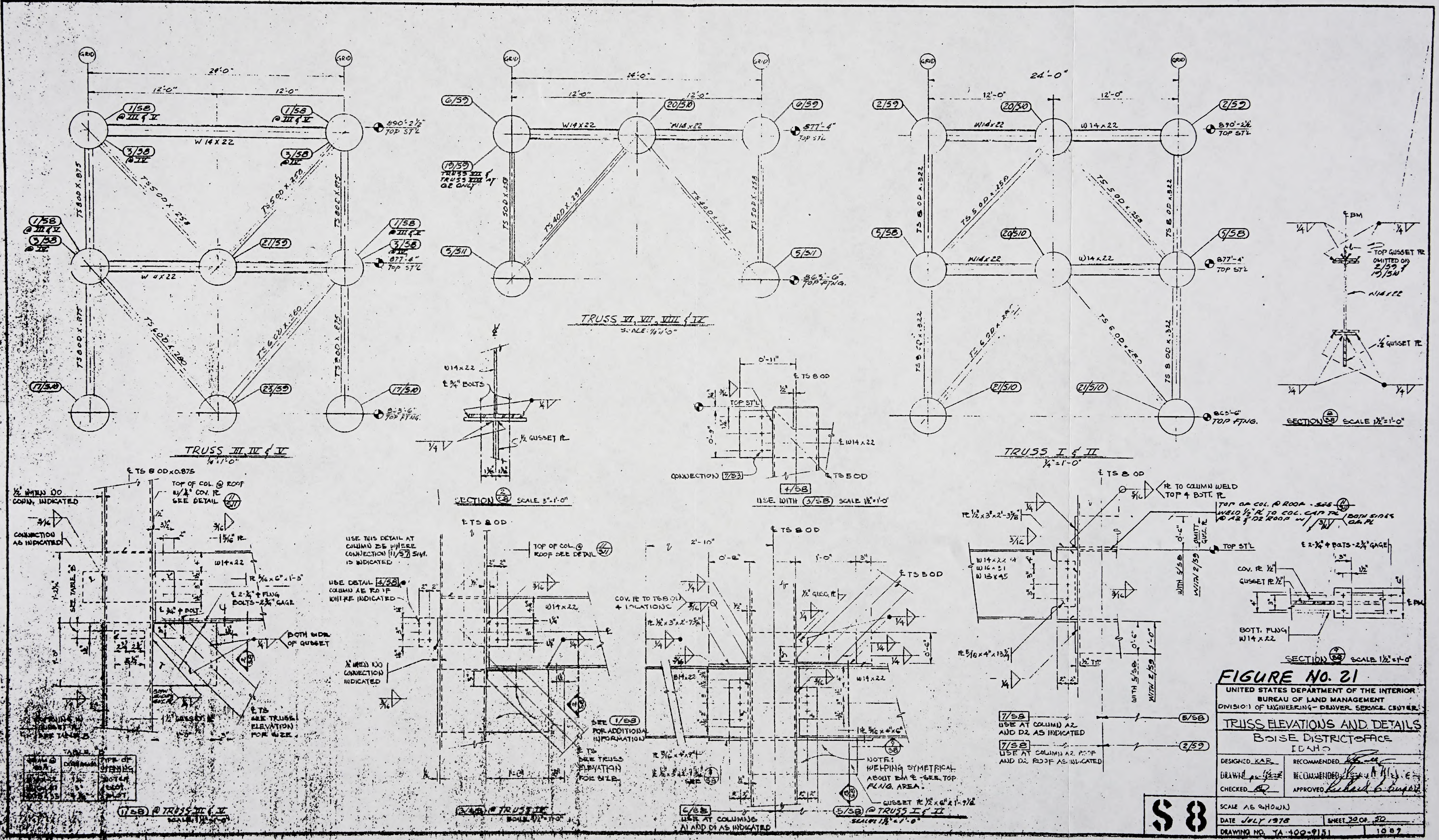

TRUSS III, IV & V
1/4"=1'-0"
TRUSS VI, VII, VIII & IX
SCALE: 1/4"=1'-0"
TRUSS I & II
1/4"=1'-0"
24'-0"
12'-0"
W14x22
TS 8 OD x .875
TS 5 OD x .258
TS 6 OD x .280
TS 4 OD x .237
TS 8 OD x .322
890'-2 1/2" TOP ST'L
877'-4" TOP ST'L
863'-6" TOP FTNG.
SECTION 2/S8 SCALE 3"=1'-0"
USE WITH 3/S8 SCALE 1 1/2"=1'-0"
CONNECTION 7/S3
SECTION 8/S8 SCALE 1 1/2"=1'-0"
SECTION 9/S8 SCALE 1 1/2"=1'-0"
1/S8 @ TRUSS III & V
3/S8 @ TRUSS IV
5/S8 @ TRUSS I & II
6/S8 USE AT COLUMNS A1 AND D1 AS INDICATED
7/S8 USE AT COLUMN A2 AND D2 AS INDICATED
7/S8 USE AT COLUMN A2 ROOF AND D2 ROOF AS INDICATED
NOTE: WELDING SYMETRICAL ABOUT BM ℄ - SEE TOP FLNG. AREA.
TOP GUSSET PL OMITTED ON 2/S9 & 10/S10
1/2 GUSSET PL
TOP OF COL. @ ROOF SEE DETAIL

FIGURE No. 21

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

TRUSS ELEVATIONS AND DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Cooper

S8

SCALE AS SHOWN
DATE JULY 1978
SHEET 30 OF 50
DRAWING NO. YA-400-9151
1087

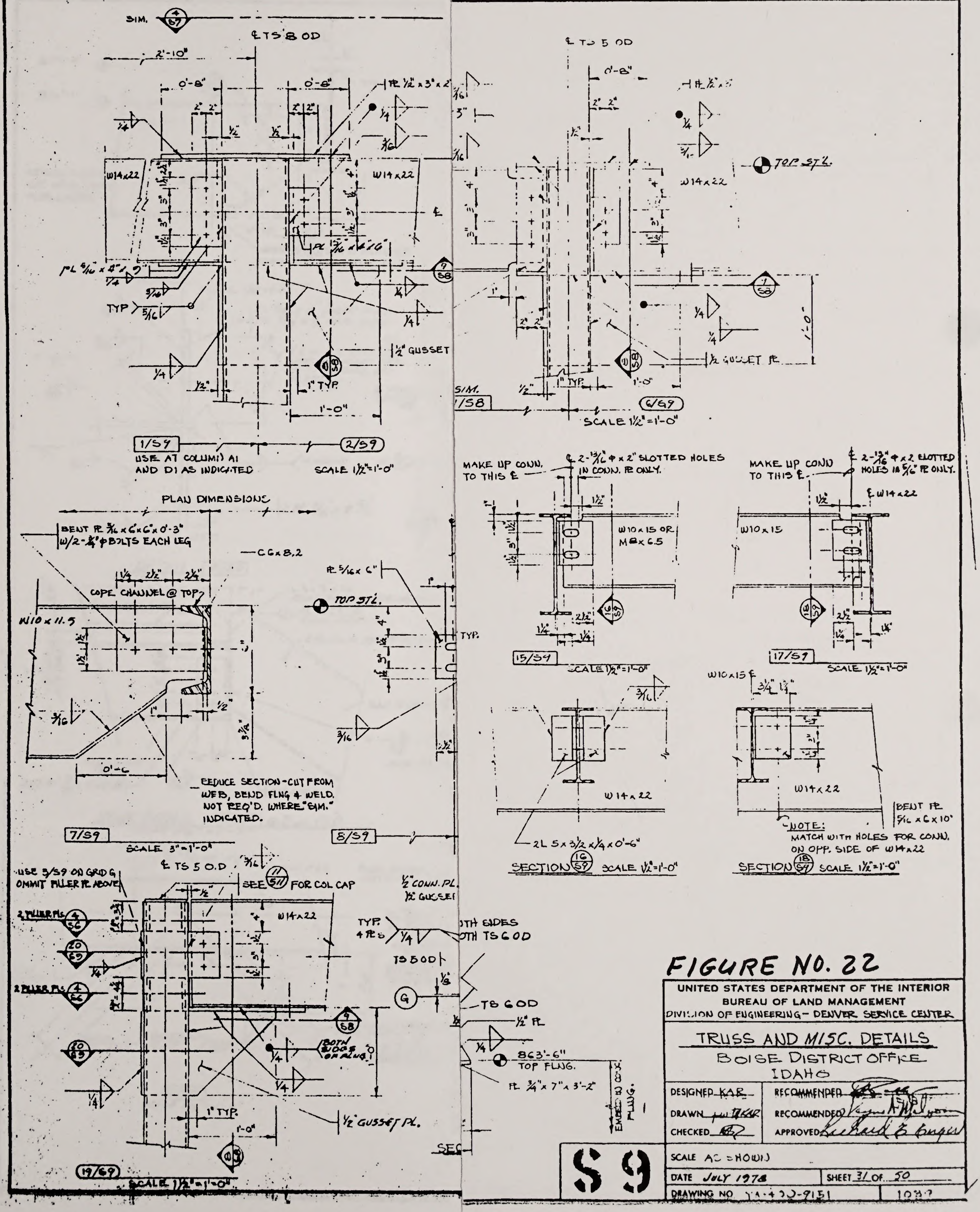


FIGURE NO. 22

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING – DENVER SERVICE CENTER

TRUSS AND MISC. DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAR
DRAWN KAR
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Conger

S 9

SCALE AS SHOWN
DATE JULY 1978
SHEET 31 OF 50
DRAWING NO YA-430-9151
1037

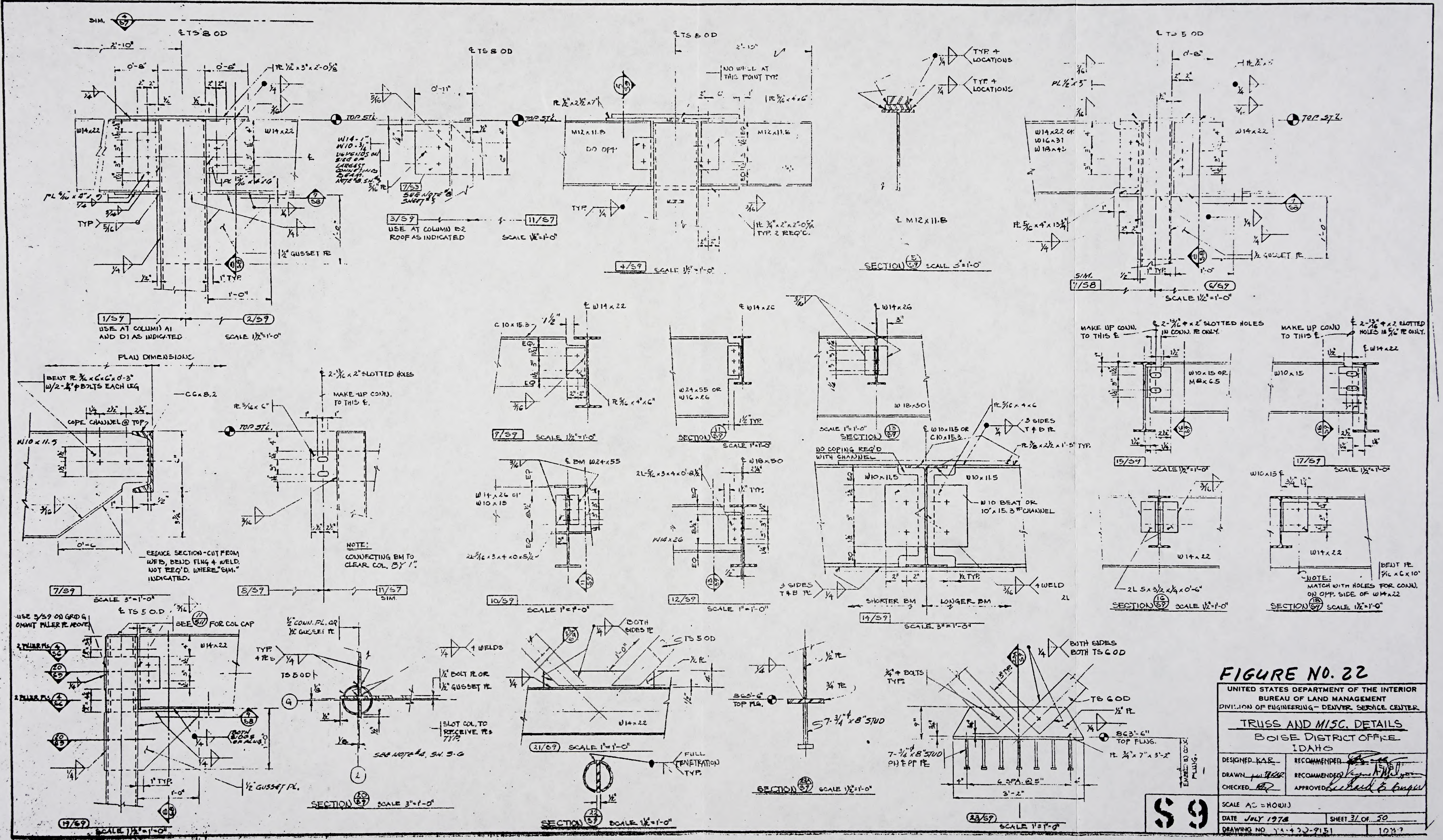


FIGURE NO. 22

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING – DENVER SERVICE CENTER

TRUSS AND MISC. DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAR
DRAWN KAR
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Bergner

S 9

SCALE AS SHOWN
DATE JULY 1978
SHEET 31 OF 50
DRAWING NO YA-420-9151
1037

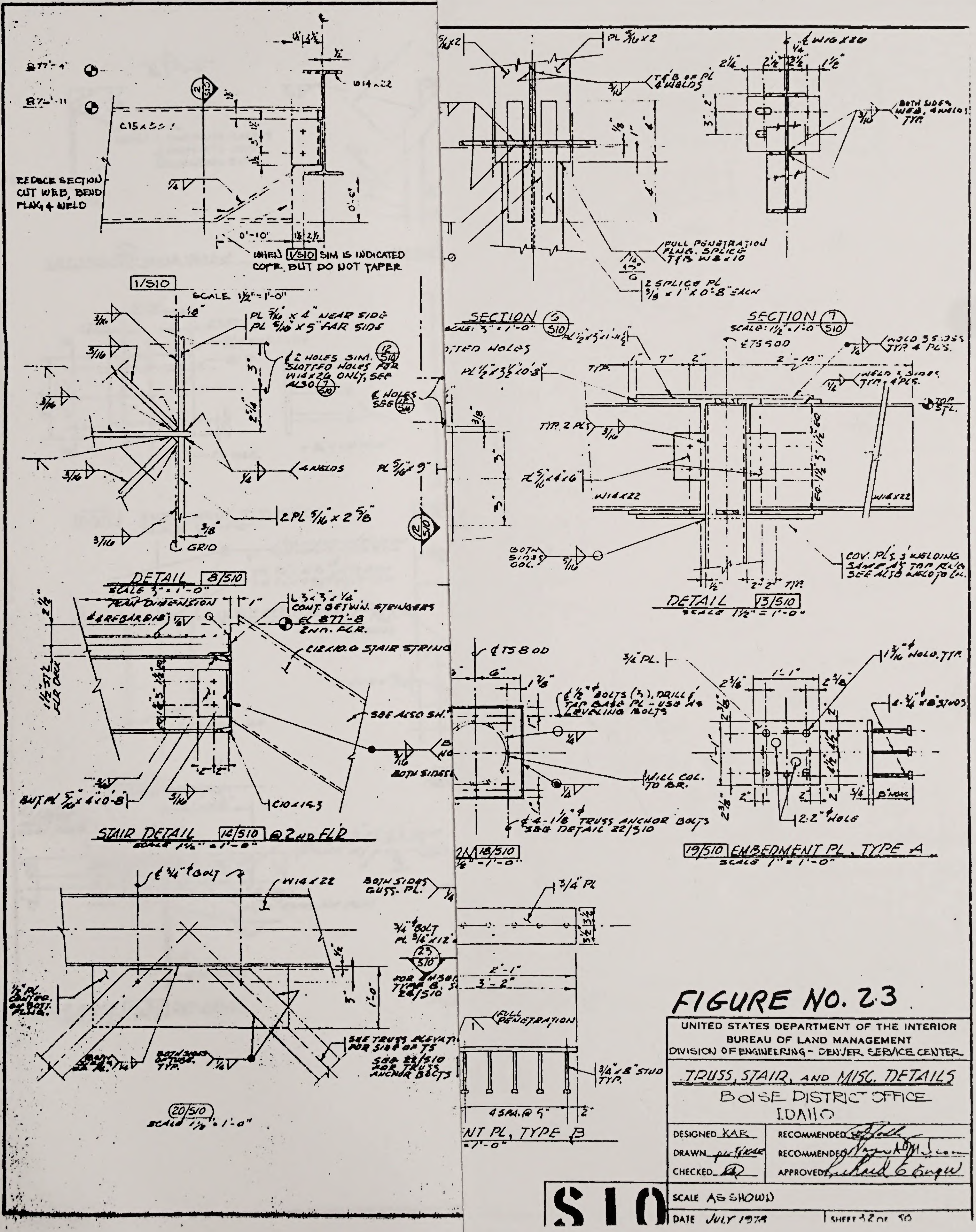


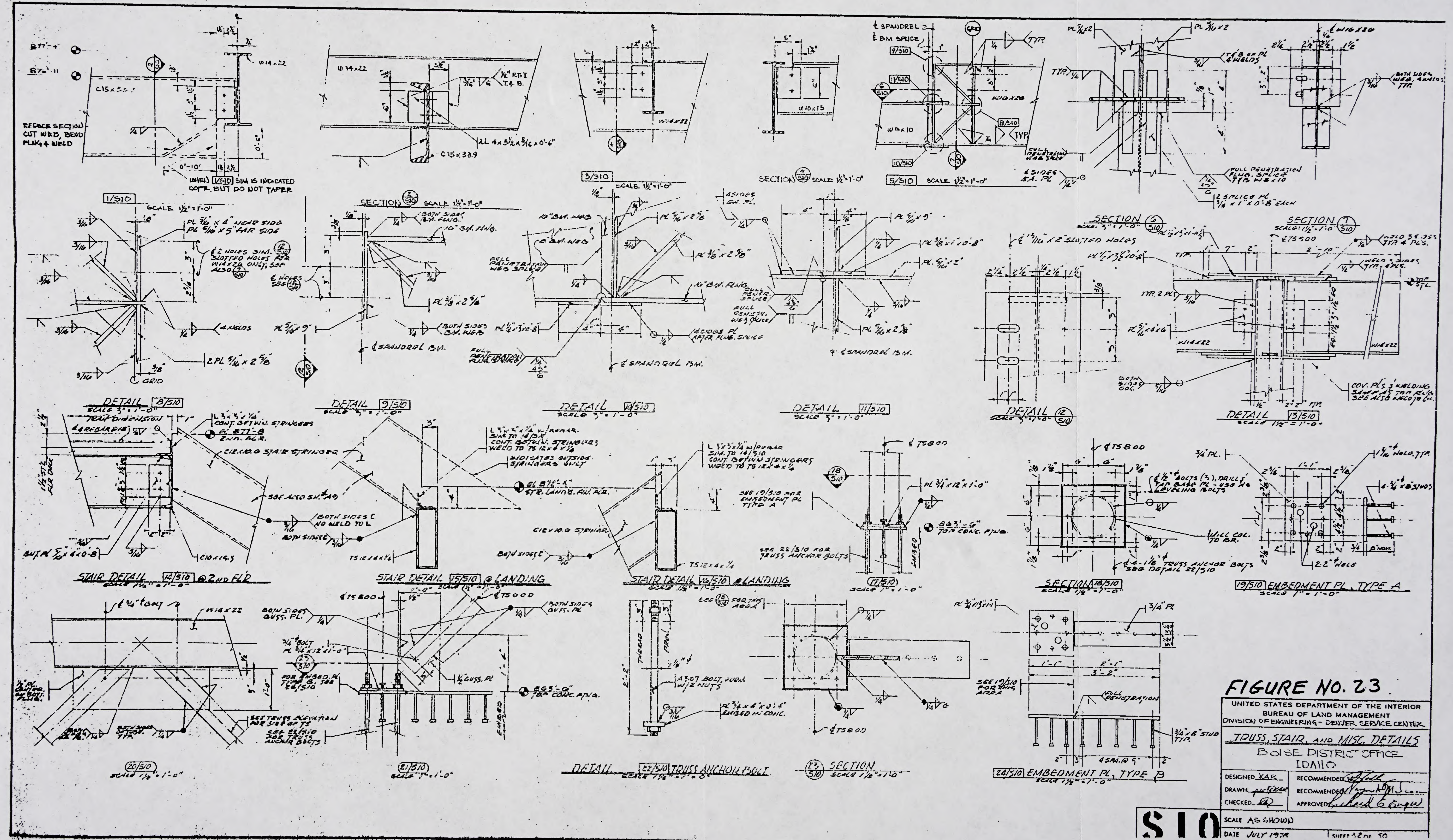
FIGURE NO. 23

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

TRUSS, STAIR, AND MISC. DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAR
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard C. Engel

S10
SCALE AS SHOWN
DATE JULY 1978
SHEET 32 OF 50



1/S10 SCALE 1/2" = 1'-0"
SECTION 2/S10 SCALE 1/2" = 1'-0"
3/S10 SCALE 1/2" = 1'-0"
SECTION 4/S10 SCALE 1/2" = 1'-0"
5/S10 SCALE 1/2" = 1'-0"
SECTION 6/S10 SCALE 1" = 1'-0"
SECTION 7/S10 SCALE 1 1/2" = 1'-0"
DETAIL 8/S10 SCALE 3" = 1'-0"
DETAIL 9/S10 SCALE 3" = 1'-0"
DETAIL 10/S10 SCALE 3" = 1'-0"
DETAIL 11/S10 SCALE 3" = 1'-0"
DETAIL 12/S10 SCALE 3" = 1'-0"
DETAIL 13/S10 SCALE 1 1/2" = 1'-0"
STAIR DETAIL 14/S10 @ 2ND FLR SCALE 1 1/2" = 1'-0"
STAIR DETAIL 15/S10 @ LANDING SCALE 1 1/2" = 1'-0"
STAIR DETAIL 16/S10 @ LANDING SCALE 1 1/2" = 1'-0"
17/S10 SCALE 1" = 1'-0"
SECTION 18/S10 SCALE 1 1/2" = 1'-0"
19/S10 EMBEDMENT PL, TYPE A SCALE 1" = 1'-0"
20/S10 SCALE 1 1/2" = 1'-0"
21/S10 SCALE 1" = 1'-0"
DETAIL 22/S10 TRUSS ANCHOR BOLT SCALE 1 1/2" = 1'-0"
23/S10 SECTION SCALE 1 1/2" = 1'-0"
24/S10 EMBEDMENT PL, TYPE B SCALE 1 1/2" = 1'-0"
REDUCE SECTION CUT WEB, BEND FLNG & WELD
WHEN 1/S10 SIM IS INDICATED COPE BUT DO NOT TAPER
W14x22
C15x33.9
2L 4x3 1/2x5/16x0'-6"
W10x15
W8x10
W10x26
¢ SPANDREL
¢ BM SPLICE
FULL PENETRATION WEB SPLICE
FULL PENETRATION FLNG. SPLICE TYP. W8x10
2 SPLICE PL 3/8 x 1" x 0'-8" EACH
PL 3/16 x 4" NEAR SIDE
PL 5/16 x 5" FAR SIDE
2 PL 5/16 x 2 5/8
¢ SPANDREL BM.
¢ SPANDREL BM.
¢ GRID
¢ 13/16 x 2" SLOTTED HOLES
C12x10.0 STAIR STRINGER
C10x15.3
TS 12x4x1/4
L 3x3x1/4 CONT. BETWN. STRINGERS
SEE ALSO SH. A9
¢ TS 8 00
3/4" BOLT
A307 BOLT, FURN. W/2 NUTS
PL 3/4 x 4" x 0'-4" EMBED IN CONC.
FULL PENETRATION
3/4" x 8" STUD TYP.
3/4" PL
863'-6" TOP CONC. FTNG.

FIGURE NO. 23

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

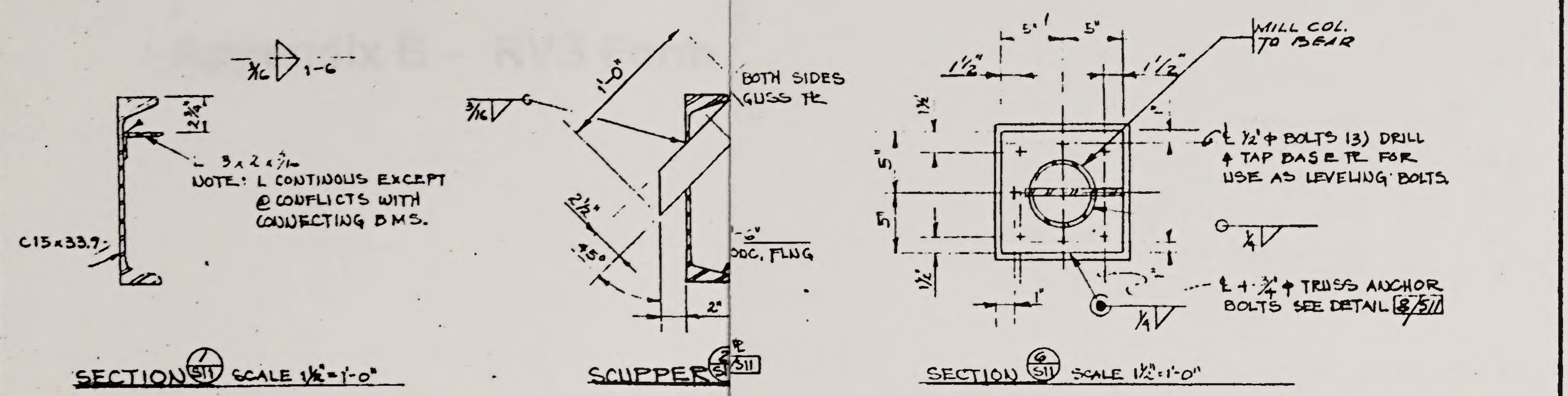
TRUSS, STAIR, AND MISC. DETAILS
BOISE DISTRICT OFFICE
IDAHO

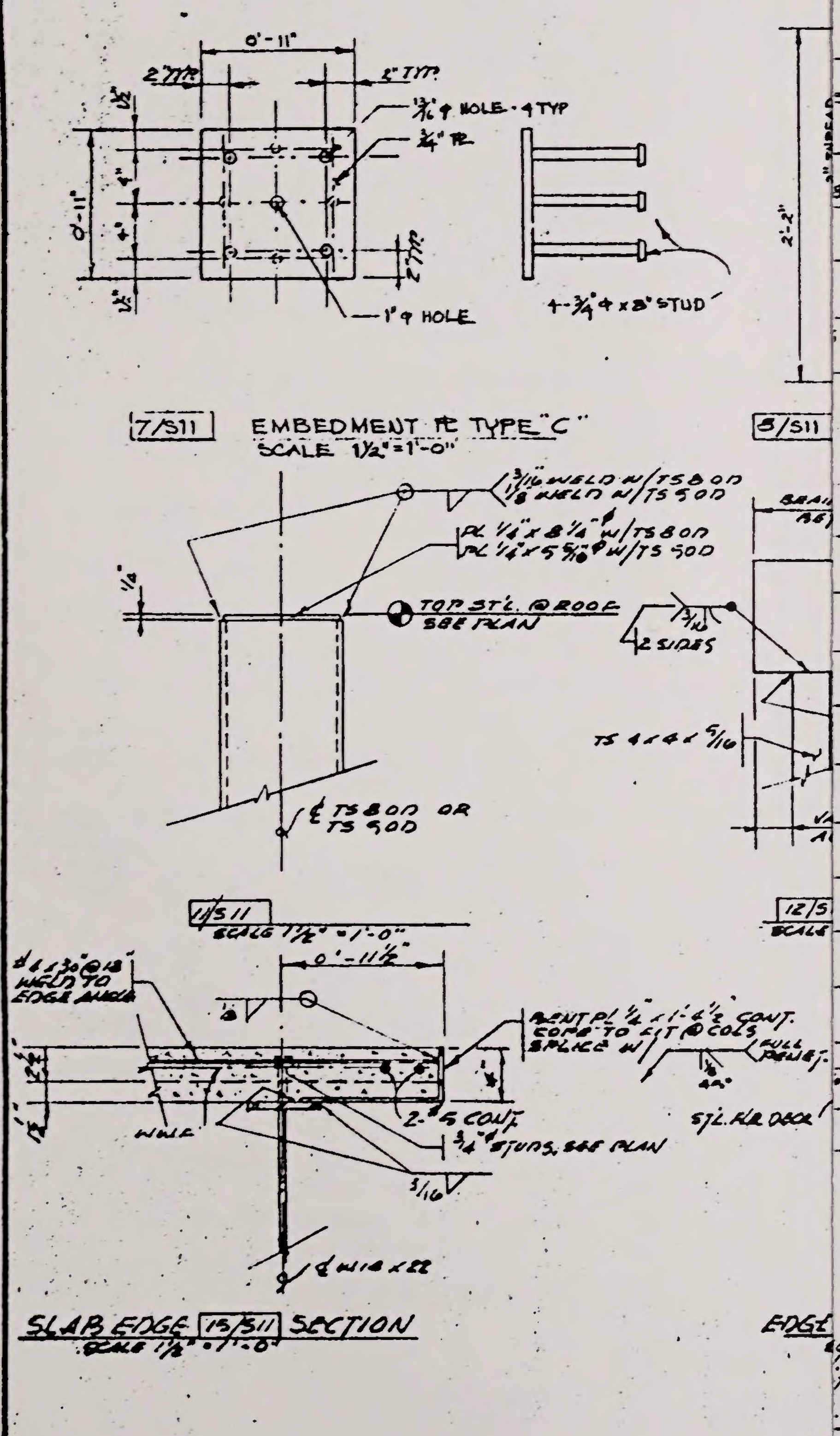
DESIGNED KAR
DRAWN KAR
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Engw

S10

SCALE AS SHOWN

DATE JULY 1978 SHEET 32 OF 50


3/16 1-6
L 3 x 2 x 1/4
NOTE: L CONTINOUS EXCEPT @ CONFLICTS WITH CONNECTING BMS.
C15 x 33.9
SECTION 1/S11 SCALE 1½"=1'-0"
1'-0"
BOTH SIDES GUSS PL
3/16
2½"
1'-6"
OC. FLNG
2"
SCUPPER 2/S11
5" 5"
1½" 1½"
MILL COL. TO BEAR
℄ ½" ⌀ BOLTS (3) DRILL & TAP BASE PL FOR USE AS LEVELING BOLTS.
1/4
℄ 4-¾" ⌀ TRUSS ANCHOR BOLTS SEE DETAIL 8/S11
1/4
SECTION 6/S11 SCALE 1½"=1'-0"



COLUMN SCHEDULE

ELEV. BOTT. OF BASE PL	BASE DETAIL	BASE PL SIZE	COLUMN SIZE	ELEV. TOP ST'L @ ROOF	TOP DETAIL
863'-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .322	890'-2½"	1/S5
863'-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .322	890'-2½"	2/S6
863'-6"	21/S10	¾"x12"x12"	TS 8 OD x .322	890'-2½"	11/S11 2/S9
863'-6"	17/S10	¾"x12"x12"	TS 8 OD x .875	890'-2½	11/S11 1/S8 OR 3/S8
863'-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .500	890'-2½"	1/S5
863-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .875	890'-2½	1/S5
863'-7¼	9/S11	¾"x13"x13"	TS 8 OD x .322	889'-10¼"	11/S11 2/S6
863'-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .322	890'-0⅜"	11/S11 2/S6
863'-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .322	889'-6"	11/S11 2/S6
863'-7¼"	9/S11	¾"x13"x13"	TS 8 OD x .322	889'-10¼"	11/S11 2/S6
863'-6"	5/S11	¾"x10"x10"	TS 5 OD x .258	877'-4"	11/S11 6/S9 OR 13/S9
863'-7¼"	9/S11	¾"x10"x10"	TS 5 OD x .258	877'-4"	1/S5
863'-7¼"	9/S11	¾"x10"x10"	TS 5 OD x .258	877'-1⅜"	11/S11 3/S6
863'-7¼"	9/S11	¾"x10"x10"	TS 5 OD x .258	876'-1¾"	11/S11 2/S6
863'-7¼"	9/S11	¾"x10"x10"	TS 5 OD x .258	876'-7½"	11/S11 6/S9
863'-7¼"	9/S11 SIM.	¾"x10"x10"	TS 5 OD x .258	876'-6 11/16"	13/S6

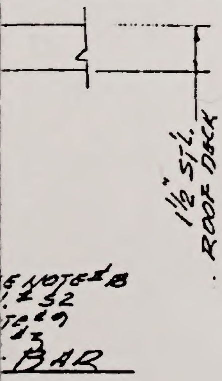


FIGURE NO. 24

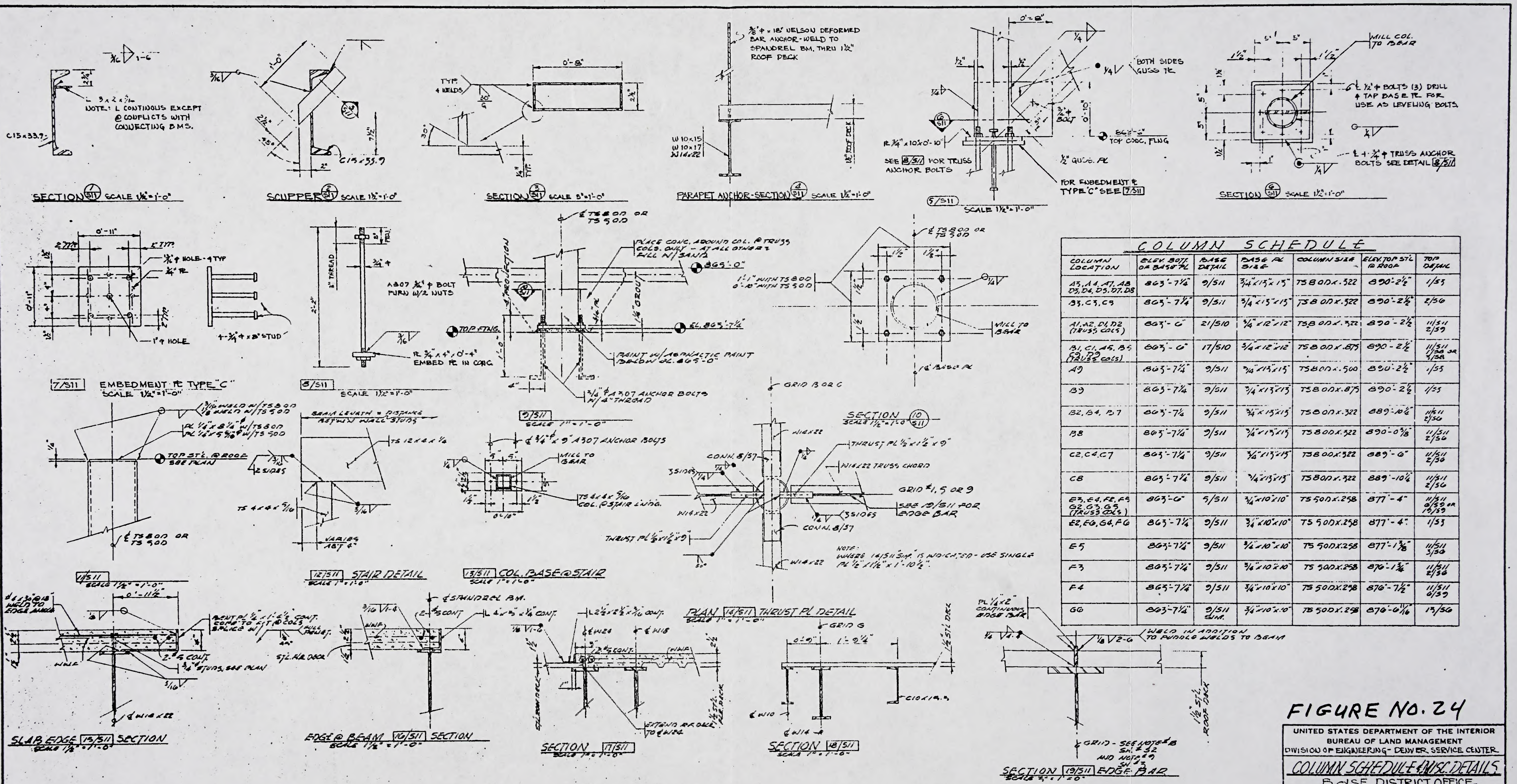
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

COLUMN SCHEDULE & MISC. DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAB
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED Richard E. Enger

S11

SCALE AS SHOWN
DATE JULY 1978
SHEET 33 OF 50
DRAWING NO. YA-400-71.51
10.31


SECTION 1/S11 SCALE 1½"=1'-0"
NOTE: L CONTINOUS EXCEPT @ CONFLICTS WITH CONNECTING BMS.
C15×33.9
SCUPPER 2/S11 SCALE 1½"=1'-0"
C15×33.9
SECTION 3/S11 SCALE 3"=1'-0"
TYP 4 WELDS
0'-8"
PARAPET ANCHOR-SECTION 4/S11 SCALE 1½"=1'-0"
⅜"φ × 18" NELSON DEFORMED BAR ANCHOR-WELD TO SPANDREL BM. THRU 1½" ROOF DECK
W10×15
W10×17
W14×22
5/S11 SCALE 1½"=1'-0"
BOTH SIDES GUSS PL
½" GUSS. PL
SEE 8/S11 FOR TRUSS ANCHOR BOLTS
FOR EMBEDMENT PL TYPE "C" SEE 7/S11
TOP CHDC. FLNG
SECTION 6/S11 SCALE 1½"=1'-0"
MILL COL. TO BEAR
½"φ BOLTS (3) DRILL & TAP BASE PL FOR USE AS LEVELING BOLTS
¾"φ TRUSS ANCHOR BOLTS SEE DETAIL 8/S11
7/S11 EMBEDMENT PL TYPE "C" SCALE 1½"=1'-0"
¾" PL
1"φ HOLE
¾"φ × 8" STUD
8/S11 SCALE 1½"=1'-0"
A307 ¾"φ BOLT FURN W/2 NUTS
PL ¾"×4"×0'-4" EMBED PL IN CONC.
℄ TS 8 OD OR TS 5 OD
PLACE CONC. AROUND COL. @ TRUSS COLS. ONLY - AT ALL OTHERS FILL W/ SAND
863'-0"
TOP FTNG.
EL. 863'-7¼"
PAINT W/ ASPHALTIC PAINT BELOW EL. 863'-0"
¾"φ A307 ANCHOR BOLTS W/ 4" THREAD
1'-1" WITH TS 8 OD
0'-10" WITH TS 5 OD
MILL TO BEAR
1½" BASE PL
GRID B OR C
SECTION 10/S11 SCALE 1½"=1'-0"
W14×22
THRUST PL ½"×1½"×9"
W14×22 TRUSS CHORD
CONN. 8/S7
GRID #1, 5 OR 9
SEE 19/S11 FOR EDGE BAR
THRUST PL ½"×1½"×9"
NOTE: WHERE 14/S11 SIM. IS INDICATED - USE SINGLE PL ½"×1½"×1'-10½".
TOP STL @ ROOF SEE PLAN
℄ TS 8 OD OR TS 5 OD
BEAM LENGTH = DISTANCE BETWN WALL STUDS
TS 12×4×⅛
TS 4×4×3/16
VARIES ABT 6"
12/S11 STAIR DETAIL SCALE 1"=1'-0"
9/S11 SCALE 1"=1'-0"
¾"φ × 9" A307 ANCHOR BOLTS
MILL TO BEAR
TS 4×4×3/16 COL. @ STAIR LNDG.
13/S11 COL. BASE @ STAIR SCALE 1"=1'-0"
1/S11 SCALE 1½"=1'-0"
BENT PL ½"×1½" CONT. COMP TO FIT @ COLS. SPLICE W/ FULL PENET.
2-#5 CONT.
¾" STUDS, SEE PLAN
W14×22
SLAB EDGE 15/S11 SECTION SCALE 1½"=1'-0"
℄ SPANDREL BM.
2-#5 CONT.
L 4×5×¼ CONT.
WWF
EDGE @ BEAM 16/S11 SECTION SCALE 1½"=1'-0"
L 2½×2½×3/16 CONT.
℄ W24
℄ W18
EXTEND RF. DECK TO ℄ W24
SECTION 17/S11 SCALE 1"=1'-0"
PLAN 14/S11 THRUST PL DETAIL SCALE 1"=1'-0"
GRID G
C10×15.3
℄ W10
℄ W14
SECTION 18/S11 SCALE 1"=1'-0"
PL ¼"×2" CONTINUOUS EDGE BAR
WELD IN ADDITION TO PUDDLE WELDS TO BEAM
1½" STL ROOF DECK
GRID - SEE NOTE #8 SH. #32 AND NOTE #9 SH. #2
SECTION 19/S11 EDGE BAR SCALE 3"=1'-0"

C O L U M N   S C H E D U L E

COLUMN LOCATION	ELEV. BOTT. OF BASE PL	BASE DETAIL	BASE PL SIZE	COLUMN SIZE	ELEV. TOP STL @ ROOF	TOP DETAIL
A3, A4, A7, A8 D3, D4, D5, D7, D8	863'-7¼"	9/S11	¾"×13"×13"	TS 8 OD × .322	890'-2½"	1/S3
B3, C3, C9	863'-7¼"	9/S11	¾"×13"×13"	TS 8 OD × .322	890'-2½"	2/S6
A1, A2, D1, D2 (TRUSS COLS)	863'-6"	21/S10	¾"×12"×12"	TS 8 OD × .322	890'-2½	11/S11 2/S9
B1, C1, A5, B5 C9, D9 (TRUSS COLS)	863'-6"	17/S10	¾"×12"×12"	TS 8 OD × .875	890'-2½	11/S11 1/S8 OR 3/S8
A9	863'-7¼"	9/S11	¾"×13"×13"	TS 8 OD × .500	890'-2½"	1/S3
B9	863'-7¼	9/S11	¾"×13"×13"	TS 8 OD × .875	890'-2½	1/S5
B2, B4, B7	863'-7¼	9/S11	¾"×13"×13"	TS 8 OD × .322	889'-10¼"	11/S11 2/S6
B8	863'-7¼"	9/S11	¾"×13"×13"	TS 8 OD × .322	890'-0⅜"	11/S11 2/S6
C2, C4, C7	863'-7¼"	9/S11	¾"×13"×13"	TS 8 OD × .322	889'-6"	11/S11 2/S6
C8	863'-7¼"	9/S11	¾"×13"×13"	TS 8 OD × .322	889'-10¼"	11/S11 2/S6
E3, E4, F2, F5 G2, G3, G5 (TRUSS COLS)	863'-6"	5/S11	¾"×10"×10"	TS 5 OD × .258	877'-4"	11/S11 6/S9 OR 10/S9
E2, E6, G4, F6	863'-7¼"	9/S11	¾"×10"×10"	TS 5 OD × .258	877'-4"	1/S3
E5	863'-7¼"	9/S11	¾"×10"×10"	TS 5 OD × .258	877'-1⅜"	11/S11 3/S6
F3	863'-7¼"	9/S11	¾"×10"×10"	TS 5 OD × .258	876'-1¾"	11/S11 2/S6
F4	863'-7¼"	9/S11	¾"×10"×10"	TS 5 OD × .258	876'-7½"	11/S11 6/S9
G6	863'-7¼"	9/S11 SIM.	¾"×10"×10"	TS 5 OD × .258	876'-0 11/16"	13/S6

FIGURE NO. 24

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF ENGINEERING - DENVER SERVICE CENTER

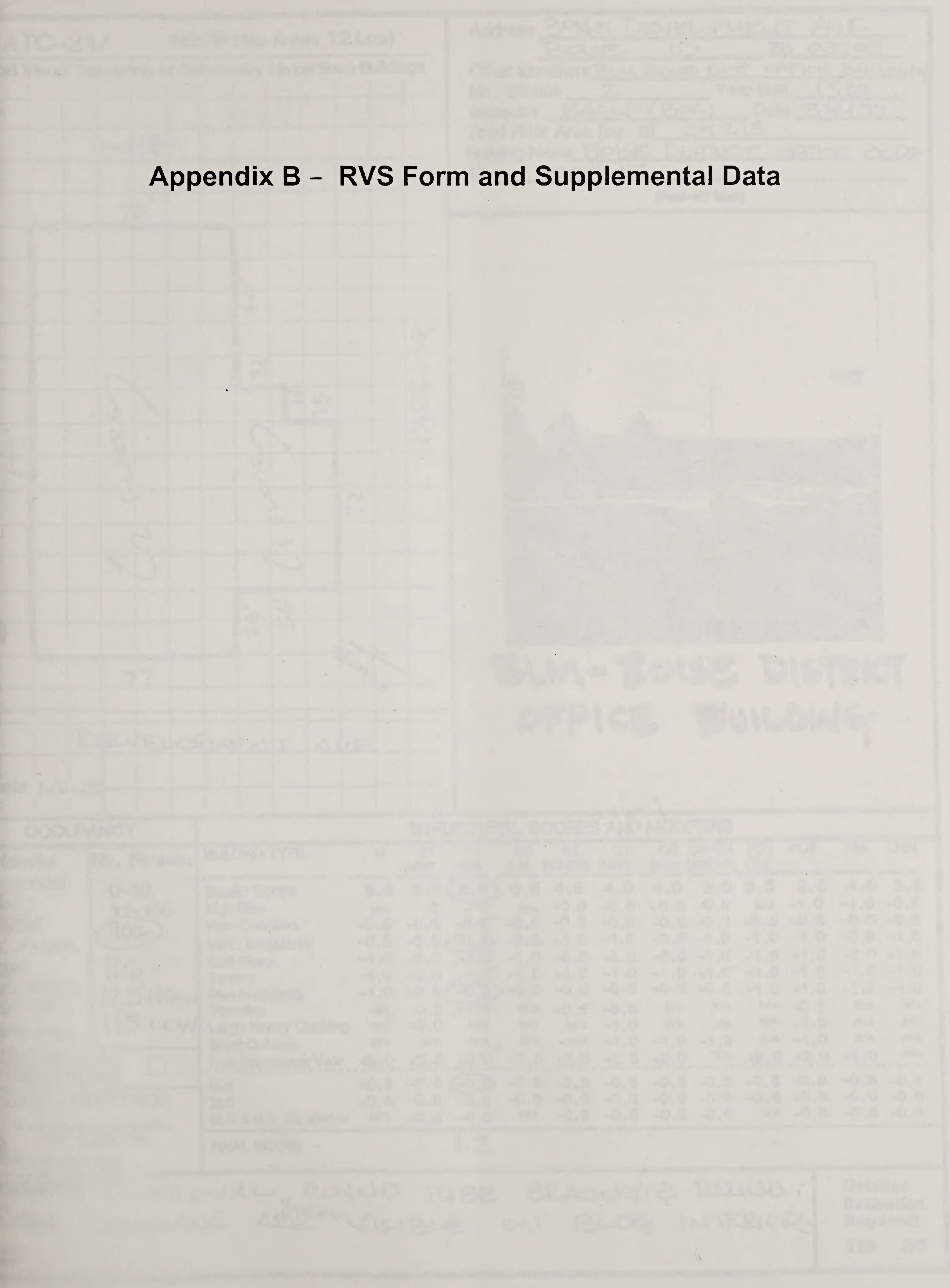
COLUMN SCHEDULE & MISC. DETAILS
BOISE DISTRICT OFFICE
IDAHO

DESIGNED KAK
DRAWN
CHECKED
RECOMMENDED
RECOMMENDED
APPROVED

S11

SCALE AS SHOWN
DATE JULY 1978
SHEET 33 OF 50
DRAWING NO. YA-420-71.51
10.31

Appendix B – RVS Form and Supplemental Data

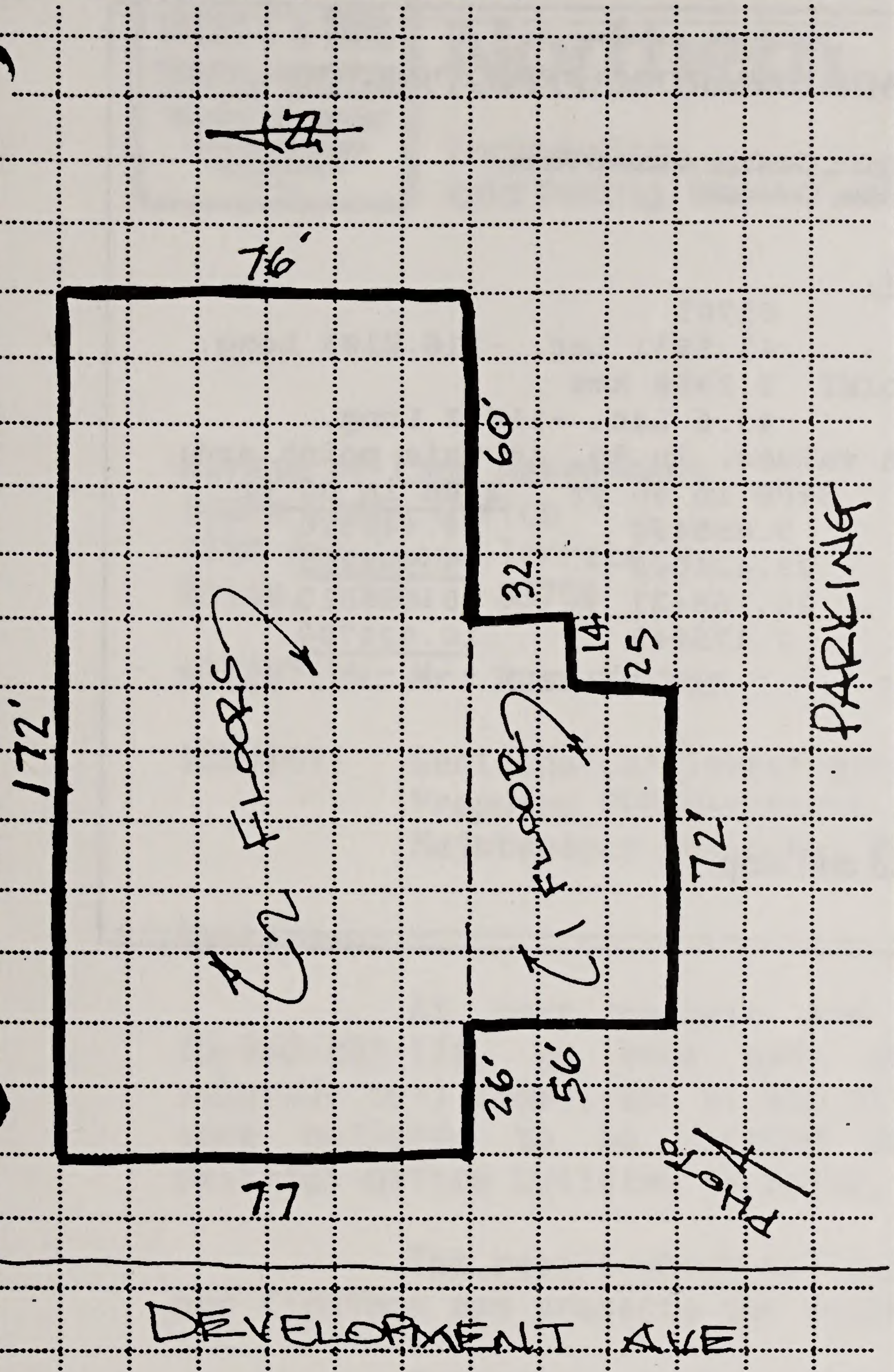


ATC-21/ (NEHRP Map Areas 1,2 Low)

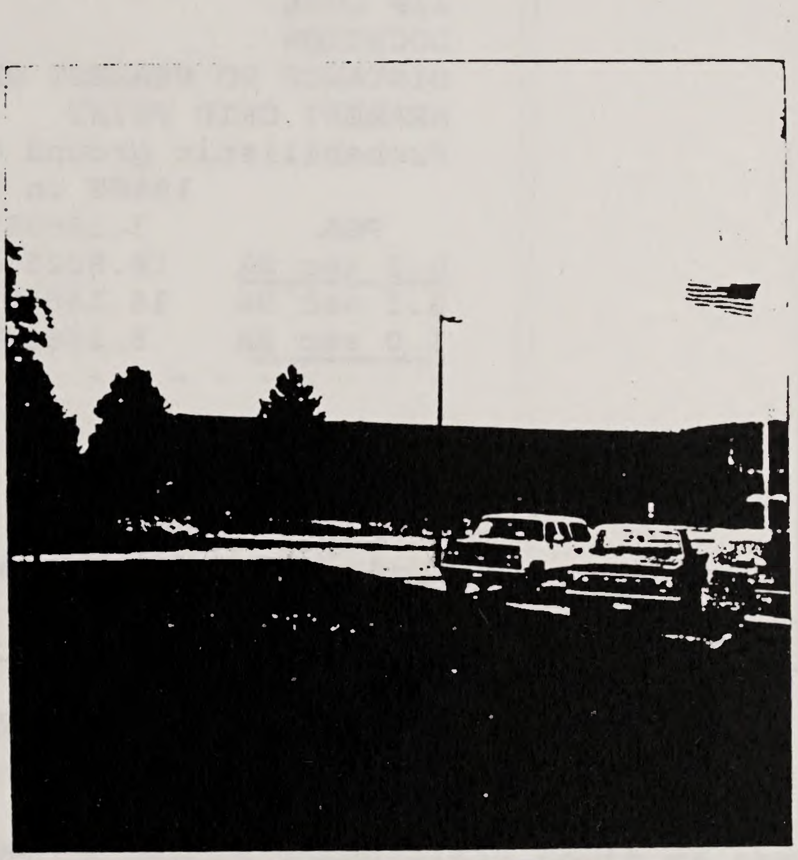
apid Visual Screening of Seismically Hazardous Buildings

Address 3948 DEVELOPMENT AVE
BOISE ID Zip 83705
Other Identifiers BLM BOISE DIST OFFICE BUILDING
No. Stories 2 Year Built 1980
Inspector BAALS (BOR) Date 8/4/97
Total Floor Area (sq. ft) 29213
Building Name BOISE DISTRICT OFFICE BLDG
Use OFFICE

(Peel-off label)



Scale: NONE



BLM-BOISE DISTRICT OFFICE BUILDING

OCCUPANCY	No. Persons
esidential	
Commercial	0-10
ffice	11-100
dustrial	100+
Pub. Assem.	
School	116
ovt. Bldg.	125 HIGH
mer. Serv.	115 LOW
istoric Bldg.	

Non Structural Falling Hazard ☐

DATA CONFIDENCE

* = Estimated, Subjective, or Unreliable Data

NK = Do Not Know

STRUCTURAL SCORES AND MODIFIERS

BUILDING TYPE	W	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	C1 (MRF)	C2 (SW)	C3/S5 (URM INF)	PC1 (TU)	PC2	RM	URM
Basic Score	8.5	3.5	2.5	6.5	4.5	4.0	4.0	3.0	3.5	2.5	4.0	2.5
High Rise	N/A	0	~~0~~	N/A	-0.5	-0.5	-0.5	-0.5	N/A	-1.0	-1.5	-0.5
Poor Condition	-0.5	-0.5	~~-0.5~~	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Vert. Irregularity	-0.5	-0.5	-0.5	-0.5	-1.0	-1.0	-0.5	-1.0	-1.0	-1.0	-0.5	-1.0
Soft Story	-1.0	-2.0	~~-2.0~~	-1.0	-2.0	-2.0	-2.0	-1.0	-1.0	-1.0	-2.0	-1.0
Torsion	-1.0	-2.0	~~-1.0~~	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Plan Irregularity	-1.0	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-1.0	-1.0	-1.0	-1.0
Pounding	N/A	-0.5	~~-0.5~~	N/A	-0.5	-0.5	N/A	N/A	N/A	-0.5	N/A	N/A
Large Heavy Cladding	N/A	-2.0	N/A	N/A	N/A	-1.0	N/A	N/A	N/A	-1.0	N/A	N/A
Short Columns	N/A	N/A	N/A	N/A	N/A	-1.0	-1.0	-1.0	N/A	-1.0	N/A	N/A
Post Benchmark Year	+2.0	+2.0	~~+2.0~~	+2.0	+2.0	+2.0	+2.0	N/A	+2.0	+2.0	+2.0	N/A
SL2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
SL3	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
SL3 & 8 to 20 stories	N/A	-0.8	-0.8	N/A	-0.8	-0.8	-0.8	-0.8	N/A	-0.8	-0.8	-0.8
FINAL SCORE			1.2									

COMMENTS DIAGONAL, ROUND TUBE BRACING & ROUND TUBE COLUMNS ARE STEEL VISIBLE ON BLDG INTERIOR.

Detailed Evaluation Required?

YES NO

ATC18LOW
80092.01

USGS

Home Page

Zipcode Lookup page

NATIONAL SEISMIC HAZARD MAPPING PROJECT

USGS, Central Region, Geologic Hazards Team
Golden, Colorado

```
The input zip-code is 83705.
ZIP CODE                             83705
LOCATION                             43.5831 Lat. -116.2183 Long.
DISTANCE TO NEAREST GRID POINT       2.3958 kms
NEAREST GRID POINT                   43.6 Lat. -116.2 Long.
Probabilistic ground motion values, in %g, at this point are:
              10%PE in 50 yr     5%PE in 50 yr     2%PE in 50 yr
   PGA          7.186087           9.855490         14.442510
0.2 sec SA     16.922501          23.424009         35.594250
0.3 sec SA     15.190550          20.168421         30.655510
1.0 sec SA      5.266269           7.175043         10.928790
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

The input zip-code is .
Zip code is zero and we go to the end and stop.
By George I think you've got it!

Northern
Engineering
and Testing, Inc.

370 Benjamin Lane
Box 7867
Boise, Idaho 83707
(208) 377-2100

June 5, 1986

Bureau of Land Management
Idaho State Office
3380 Americana Terrace
Boise, Idaho 83706

ATTENTION: Mr. Russ Huskey

SUBJECT: Geotechnical Investigation;
Proposed BLM Warehouse and
Maintenance Building; Boise, ID

Gentlemen:

At your request and in accordance with your Requisition No. ID-940-RQ6-116, we have made an investigation of subsurface foundation and subgrade soil conditions at the site of your proposed warehouse and maintenance building to be located on Commerce Avenue immediately south of the BLM District Office building in Boise, Idaho.

The report which follows describes our investigations, summarizes our findings and presents our recommendations.

Subsoils at the site consist of thin layers of lean clay underlain by cemented sandy silt. These materials are, in turn, underlain by dense, poorly graded sandy gravel with cobbles.

Conventional spread footings are recommended for support of structural loads.

In order for you to better understand this report and the limitations of geotechnical studies with respect to findings, opinions, and recommendations, we have included in the Appendix an information sheet on this topic. If you have any questions regarding this report or if we can be of further service, please contact us at your convenience.

Respectfully submitted,

Richard Kane

Richard T. Kanemasu, P.E.

Roger W Pocta

Roger W. Pocta, P.E.

1654

RTK/RWP/yt
Enclosure
In quadruplicate

REPORT
OF
GEOTECHNICAL INVESTIGATION

BLM WAREHOUSE AND MAINTENANCE BUILDING
BOISE, IDAHO

TO:
BUREAU OF LAND MANAGEMENT
BOISE, IDAHO

PREPARED
BY
NORTHERN ENGINEERING AND TESTING, INC.
BOISE, IDAHO

JUNE, 1986

INTRODUCTION

The purpose of this investigation was to obtain information concerning subsurface conditions and engineering properties of the subsoil on which to base recommendations for design and construction of foundations and paved areas for a proposed BLM warehouse and a maintenance shop facility to be located on Commerce Avenue immediately south of the BLM District office in Boise, Idaho.

Preliminary design details indicate that the two proposed buildings will consist of single-story, slab-on-grade construction. Foundation loads are estimated to be moderate to light. The proposed facility will also include new pavement to be constructed between the two structures and capable of supporting heavy truck traffic. A new surface water disposal system will be constructed near the northeast corner of the site.

SITE INVESTIGATION

After a careful visual inspection of the site, 8 test borings were drilled to depths varying from 9.7 to 11.0 feet at locations shown on the enclosed Drawing No. 86-1357-1. Boring locations were determined by tape measurement from a north/south trending concrete curb along the east side of the site and an east/west trending fence on the north side of the facility. Test boring elevations were determined by level survey. The location and elevation of the borings should be considered accurate only to the degree implied by the method used.

The field investigation was performed under the direction of our field engineer. Continuous logs of the soil conditions were recorded, standard penetration resistance tests made, and disturbed and undisturbed samples obtained during the field exploration program.

LABORATORY INVESTIGATION

Samples obtained during the field exploration were taken to the laboratory where they were carefully inspected and visually classified in accordance with ASTM D2487 which is based on the Unified Soil Classification System. A chart of this classification system is shown in the Appendix. Representative samples were selected for tests to determine engineering and physical properties of the soils in accordance with ASTM or other approved procedures.

These included:	To determine:
Grain-size distribution............	size and distribution of soil particles, i.e., clay, silt, sand, gravel.

These included:	To determine:
Atterberg limits....................	the consistency and stickiness, as well as the range of moisture content within which the material is workable.
Natural moisture....................	moisture content representative of field conditions at time sample was taken.

Results of all field and laboratory tests are summarized on the enclosed test boring logs and plates. Sampling and testing procedures are further described in the Appendix.

SITE AND SUBSOIL CONDITIONS

The two building sites are currently a portion of a large graveled area used for storage of trucks and miscellaneous vehicles. It is relatively flat with approximately 3 feet of relief between test boring locations and the ground slopes downward from south to north. Geologically, the site is a portion of a geologic flood plain of the Boise River. The subsurface profile consists of this layer of fill overlying natural alluvial soil. The fill, varying in thickness from 0.4 to 3.0 feet, was encountered in all the test borings. A 6-inch layer of fill was also encountered in Drill Hole 6 at a depth of 4.5 to 5.0 feet. In this location, it appears that the test boring extended through a portion of an undercut trench since undisturbed natural soils were encountered above and below the fill layer. Natural subsoils generally consist of lean clay or silty clay extending to depths ranging from 1.7 to 4.5 feet. This is underlain in almost all the borings by cemented sandy silt extending to depths ranging from 4.0 to 9.0 feet. Underlying these materials is a poorly graded gravel-sand extending to the maximum depth explored in all of the test borings. Individual subsurface layers are described in more detail on the logs in the Appendix and in order of increasing depth in the following paragraphs.

Fill - Fill generally consists of poorly graded gravel with sand and cobbles along with 3/4 inch crushed base course which has been placed over most of the site to provide a pavement surface. The exceptions are Drill Holes 5, 6, and 7, where a substantial thickness of clayey gravel with sand or silt with sand fill has been placed apparently during previous grading of the site. BLM personnel report that there might be deeper isolated fills within the site which could contain garbage, although this was not encountered during the investigation. There is no indication that any of the fill on the site was compacted when placed and it is, therefore, assumed to be potentially highly compressible and unsuitable for support of either buildings or pavement.

Lean Clay or Silty Clay - This is the predominate material in the upper portion of the profile and consists of a moderately plastic material with a plasticity index ranging from 6 to 18 percent. It is generally stiff to hard in consistency and is expected to be slightly compressible and relatively strong in support of light to moderate foundation loads. It will provide a relatively poor subgrade for support of pavements and, if wet, will readily pump and rut under the action of heavy, rubber-tired machinery. The moisture content of this material at the time of our investigation is estimated to be at or slightly above optimum moisture for compaction.

Sandy Silt - This is a relatively hard layer consisting of generally nonplastic material which has been strongly cemented. It will be very strong and relatively incompressible in support of light to moderate foundation loads. It is also relatively impervious to water.

Poorly Graded Gravel with Sand - This is a clean, dense alluvial gravel containing rounded aggregate and cobbles in a fine to coarse sand matrix. This material is well-known for its high strength and low compressibility. Field drain systems for surface water disposal typically extend into this layer because of its high permeability.

The stratification lines shown on the logs represent the approximate boundary between soil types; the actual in-situ transition may be gradual.

Groundwater was not encountered in any of the test borings at the time of drilling. Numerous factors contribute to groundwater fluctuations and evaluation of such factors is beyond the scope of this report.

ENGINEERING ANALYSIS

Foundations

Structural loads for the proposed buildings can be supported using conventional spread footings bearing either on undisturbed natural soil or properly compacted structural fill. Existing fill will not be suitable for foundation or floor slab support and must be carefully removed from proposed building areas. It is assumed that resulting excavations will be backfilled with compacted structural fill. Foundations for an individual structure could be supported on both lean clay or structural fill. Since these materials have different compressibility, a relatively conservative allowable bearing pressure has been selected to minimize differential settlement between foundations supported on these different materials. Footings designed in accordance with the recommended allowable bearing pressure should experience total settlement less than 3/4 inch and corresponding differential settlement less than 1/4 inch.

Earthwork and Site Grading

Clay soil comprising the upper portion of the profile will be incapable of supporting heavy, rubber-tired construction equipment unless it is relatively dry. At moisture content measured during this investigation, it is only marginally capable of supporting heavy, rubber-tired construction equipment but would rapidly strengthen once vegatation and fill are stripped and the subgrade is exposed to hot, dry weather. Attempts to operate such equipment on the subgrade during wet conditions will result in severe disturbance of the soil including pumping and rutting. Disturbed material will not be suitable for support of floor slabs, foundations, or pavements and will have to be subexcavated and replaced with compacted structural fill to reestablish adequate support. The possibility of this condition suggests that a number of precautions may have to be observed during construction as follows.

1. If soft, wet, pumping soil conditions are encountered, prohibit the use of heavy, rubber-tired construction equipment on these materials. This could require that fill stripping, rough grading, and spreading of initial layers of structural fill or pavement components be performed with track-mounted dozers, unless the subgrade can be allowed to dry and harden during appropriate weather conditions.

2. Site grading, placement of structural fill and excavations for foundations must be performed during dry weather. In the event that the construction schedule will require access by heavy, rubber-tired trucks to the building area during wet weather, such traffic should be confined to temporary haul roads consisting of at least 18 inches of pitrun gravel underlain by a woven geotextile fabric.

Pavement

Truck access drives have been designed assuming that the predominate subgrade will be a lean clay having an estimated California Bearing Ratio (CBR) of 6. It is assumed that this pavement will be subject to approximately 50 large trucks per day. This information has been used, along with the design procedure of the American Association of State Highway and Transportation Officials (AASHTO) to provide recommended thickness for pavement components. It has been assumed that all existing fill will be removed from paved areas and that construction will be performed only during dry weather so that machinery can operate on the lean clay subgrade. It may be necessary to adjust the construction schedule so that pavement areas can be stripped of fill and then allowed to dry prior to intensive operation of equipment on the area.

RECOMMENDATIONS

Site Preparation

1. All topsoil, organic material, and fill should be removed from proposed building and paved areas. If there is a tendency for the subgrade soil to pump or rut under the action of heavy, rubber-tired construction equipment, then all stripping operations should be performed with light, track-mounted dozers. Under these conditions, any heavy, rubber-tired equipment that must operate on the site should be confined to temporary haul roads constructed in accordance with the discussion in the Engineering Analysis of this report. Alternatively, site grading, earthwork, and pavement construction should be performed only during dry weather and only after the subgrade has been allowed to dry and harden.

2. All structural fill should consist of a clean, well-graded, 6-inch-minus pitrun sand or gravel containing less than 10 percent passing the No. 200 mesh sieve. Backfill against foundations may consist of on-site clay, silt or gravel soil, or existing fill free of organics and debris, all of which has been moisture conditioned to attain optimum moisture for compaction. All structural fill and backfill should be placed in thin lifts and compacted to the following densities.

	Percent Relative Density Determined by ASTM D4253 and ASTM D4254 (Clean Sand or Gravel)	Percent Maximum Dry Density Determined by ASTM D698 (On-Site Sand-Silt or Clay
Beneath and within 5 feet of footings	70	--
Against foundation walls	65	95
All other locations	65	95

The moisture content of on-site soil selected for use as structural fill may require adjustment to attain optimum moisture content for compaction.

Northern
Engineering
and Testing, Inc.

APPENDIX

REPORT OF
GEOTECHNICAL INVESTIGATION

BUREAU OF LAND MANAGEMENT
WAREHOUSE AND MAINTENANCE BUILDING
BOISE, IDAHO

APPENDIX

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, thanks to the Association of Soil and Foundation Engineers (ASFE).

When ASFE was founded in 1969, subsurface problems were frequently being resolved through lawsuits. In fact, the situation had grown to such alarming proportions that consulting geotechnical engineers had the worst professional liability record of all design professionals. By 1980, ASFE-*member consulting soil and foundation engineers had the best professional liability record*. This dramatic turn-about can be attributed directly to client acceptance of problem-solving programs and materials developed by ASFE for its members' application. *This acceptance was gained because clients perceived the ASFE approach to be in their own best interests.* Disputes benefit only those who earn their living from others' disagreements.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of his report may affect his recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used*:

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

A geotechnical engineer cannot accept responsibility for problems which may develop if he is not consulted after factors considered in his report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by the geotechnical engineer who then renders an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those opined to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. For example, the actual interface between materials may be far more gradual or abrupt than the report indicates, and actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultant through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy

EXPLORATION AND LABORATORY TESTING

Exploration

Field exploration is performed using a truck-mounted rotary drilling machine equipped with augers. Standard penetration testing and undisturbed sampling can be performed through our hollowstem auger, which serves as casing. The soils are continuously logged by an engineer or geologist and classified by visual examination in accordance with the ASTM Soils Classification System.

Samples of soils are taken at frequent intervals in the boring excavation. Disturbed samples are normally taken by the standard penetration test. This test is made by driving a 2 inch O.D. split-spoon sampler 18 inches into the soil by striking it with a 140 pound hammer dropping 30 inches. The total number of blows required to advance the sampler the second and third 6 inch increments is the standard penetration resistance. Undisturbed samples are obtained from layers of soil that are critical to the analysis. Samples of representative soils are obtained by pushing, or possibly driving, a thin-walled steel sampler into the soil layer. These thin-walled shelby tubes are used to sample sensitive soils that are easily disturbed.

Laboratory Classification & Testing

The field classification is verified in the laboratory, where all of the samples are classified by an experienced person other than the one who made the field classification. The classification process in the laboratory normally includes estimation of the percents of gravel or rock fragments, sand, silt, and clay fractions, and the liquid and plastic limits. The natural moisture content of all fine-grained soil and bedrock samples is determined.

Based on the classification tests, one or more of each representative type of soil encountered may be selected for more detailed analysis. The data from the field and laboratory investigations is used to prepare the final test boring logs.

Moisture - Natural Density

Moisture content and in-place dry density tests are utilized to determine local variations in soil consistency. This information can also provide a correlation between soils found at this site and other sites in the general area. The moisture content of selected undisturbed samples, or of in-place soil layers, and the moisture content of all cohesive or fine-grained samples, are determined.

IDAHO GUIDELINE CONSTRUCTION AND MATERIALS REQUIREMENT FOR PAVEMENT SECTIONS

1. Minimum Compaction Requirements

Material	Percent of Maximum	Method
Asphaltic Concrete Surfacing or Base	97	ASTM D1559 (Marshall)*
	or 92	ASTM D2041
Crushed or Uncrushed Granular Base/Subbase Coarse	95	ASTM D698
Subgrade (top 6 inches)	95	ASTM D698

* 50 blows each end of specimen; sampled from truck at time of production. Compaction density may also be controlled by field test strip methods in accordance with State of Idaho Division of Highways Specification 405.16. We are available to provide recommendations upon request.

Maximum compacted lift thickness should be 3 inches for asphaltic concrete and 12 inches for granular base/subbase course. Minimum lift thickness for gravels should be twice the maximum size of aggregate.

2. Aggregate Base Course Grading Requirements

Screen or Sieve Size	3/4-Inch Crushed Base	1-Inch Crushed Base Course*		3-Inch Uncrushed Subbase Course
		Grading A	Grading B	
	PERCENT PASSING			
3"				100
2"			100	
1-1/2"		100		
1"	100	90 - 100	90 - 100	45 - 100
3/4"	90 - 100			
1/2"		60 - 80	65 - 100	
No. 4	40 - 65	35 - 60	40 - 80	25 - 60
No. 8	30 - 50	25 - 50	30 - 60	
No. 30		10 - 30	15 - 35	
No. 200	3 - 9	2 - 9	6 - 18	0 - 12

* A minimum of 50 percent of the aggregate by weight retained on the No. 4 shall have at least one fractured face as determined by Idaho T-71. The sand equivalent shall not be less than 30 if 5 percent or more passes the No. 200 mesh sieve.

In addition to the grading specifications shown, aggregate quality should conform to the following Idaho Division of Highway Specifications:

Material	IDH Specifications
Crushed Base	703.04
Uncrushed Subbase	205.06

3. Asphaltic Concrete Aggregate Production Grading Requirements

Screen or Sieve Size	Asphaltic Concrete Surfacing or Base
	PERCENT PASSING
1"	100
3/4"	90 - 100
No. 4	40 - 65
No. 8	30 - 50
No. 200	3 - 9

In addition to the grading requirements shown, the aggregate quality should conform to the applicable portions of Idaho Division of Highways Specifications 703.04 and 703.05.

4. Asphaltic concrete mix designs should be submitted by the contractor, and should meet the following requirements:

Property	Test Method	Asphaltic Concrete Surfacing	Base
Stability, lbs., minimum	ASTM D1559*	800	500
Flow, units of 0.01 inches	ASTM D1559*	8 - 18	8 - 18
Air Voids, percent	Asphalt Institute Manual MS-2	3 - 5	3 - 8
Immersion Compression:	ASTM D1075		
Retained Strength, percent		70	70
Dry Compressive Strength, psi, minimum		200	200
Voids in Mineral Aggregate (VMA), percent minimum		14	12 or 14

*50 blows each end of specimen.

LOGS OF EXPLORATIONS

EXPLANATION OF ABBREVIATIONS AND DESCRIPTIVE TERMS

SSS (SPT) - Standard penetration resistance test -- results recorded as the number of blows of a 140-pound hammer falling 30 inches required to drive a 2-inch O.D. split sample spoon the second and third 6-inch increments of an 18-inch distance.

LSS - Modified penetration test -- results recorded as the number of blows of a 140-pound hammer falling 30 inches required to drive a 2.5-inch O.D. split sample spoon the second and third 6-inch increments of an 18-inch distance.

CPT - Cone penetration test -- results recorded as the number of blows of a 140-pound hammer falling 30 inches required to drive a 1-13/16-inch-diameter cone one foot.

SRS - Split barrel ring sample 2-inches I.D. for taking undisturbed samples.

LRS - Split barrel ring sampler 2.5-inches for taking undisturbed samples.

STS - Shelby tube sample for taking undisturbed samples (2" to 3-5/16" I.D.).

Sack (SK) or Bag - Sample of disturbed soil placed in canvas sack or plastic bag.

GWL - Groundwater level on day of completion of field investigations.

FD - In-place dry density.

RQD - Rock quality designation (RQD) for the bedrock samples are determined for each core run by summing the length of all sound, hard pieces of core over 4 inches in length, and dividing this number by the total length of the core run. This value, along with the core recovery percentage, is recorded on the drill logs.

GNP - Granular Non-plastic.

PP - Unconfined compressive strength in tons per square foot determined with a hand held pocket penetrometer on the sample in the field.

GRAIN SIZES

U.S. Standard Series Sieve | Clear Square Sieve Openings

	200	50	16	4	3/4"	3"	6"
Silts & Clays Distinguished on Basis of plasticity	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

MOISTURE CONDITION (INCREASING MOISTURE --------->)

Dry	Slightly Moist	Moist (PL)	Very Moist	Wet	Saturated (LL)

CONSISTENCY		RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	Very Loose	0 - 4
Soft	3 - 4	Loose	5 - 10
Firm	5 - 8	Medium Dense	11 - 30
Stiff	9 - 15	Dense	31 - 50
Very Stiff	15 - 30	Very Dense	Over 50
Hard	Over 30		

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487 - 83
(Based on Unified Soil Classification System)

SOIL ENGINEERING

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded grave
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			$PI < 4$ or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay[K,L,M,P] Organic silt[K,L,M,O]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E] $Cu = D_{60} / D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥30% plus no. 200, predominantly sand, add "sandy" to to group name.

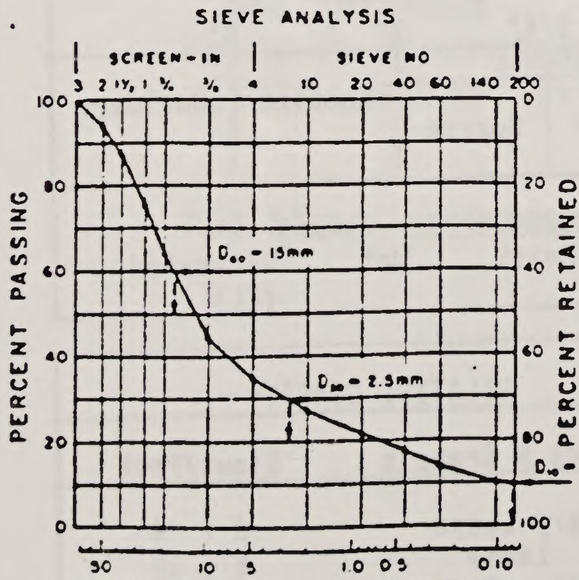
[M] If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI≥4 and plots on or above "A" line.

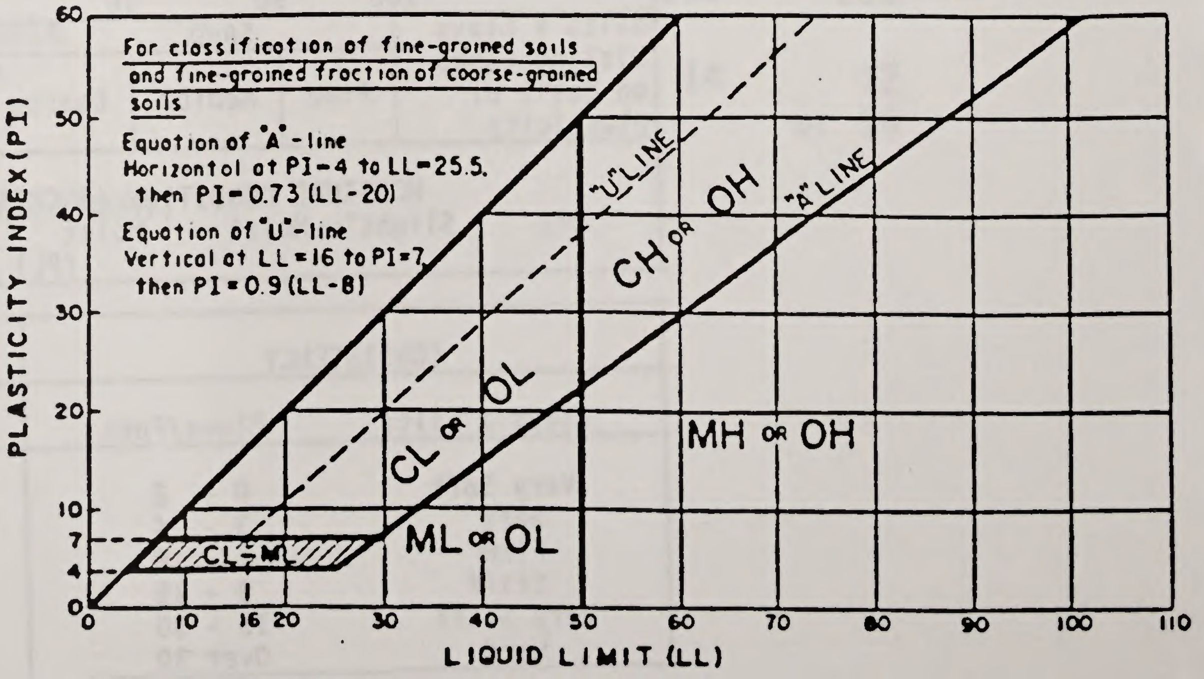
[O] PI<4 or plots below "A" line.

[P] PI plots on or above "A" line.

[O] PI plots below "A" line.



$C_u = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200 \qquad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = \frac{(2.5)^2}{0.075 \times 15} = 5.6$



Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
HOLE NO. DH-1
SHEET 1 OF 1
JOB NO.: 86-1357
LOCATION See Drawing No. 86-1357-1
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
ELEVATION: TOP OF HOLE 2864.1'
DRILLED BY: D. Rose
GROUNDWATER None
LOGGED BY: M. Petaja
DATE: HOLE STARTED 5/14/86
REMARKS:
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS / FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Well Graded GRAVEL with Sand; medium dense, crushed, minus 3/4".										
0.4		Lean CLAY; very stiff, slightly moist, plastic, dark brown, (CL).										
			bag	--	23	--	35	18	0	5	95	
			SSS	16	---							
			SSS	76/.8	26							
2.7		Sandy SILT; hard, slightly moist, nonplastic, medium to fine sand, strongly cemented, white to pink, caliche, (ML).										
4.0		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 10" diameter, subrounded, medium to fine sand, weakly cemented, brown (GP).										
			SSS	50/.5	---							
9												
			SSS	98	---							
11.0		Bottom of Hole										

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
JOB NO.: 86-1357
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
DRILLED BY: D. Rose
LOGGED BY: M. Petaja
REMARKS:

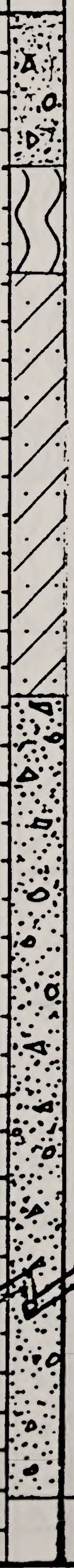
HOLE NO. DH-2
SHEET 1 OF 1
LOCATION See Drawing No. 86-1357-1
ELEVATION: TOP OF HOLE 2864.7'
GROUNDWATER None
DATE: HOLE STARTED 5/14/86
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Poorly Graded GRAVEL with Sand and Cobbles; medium dense, cobbles to 8" diameter, subrounded, crushed minus 3/4" on surface.										
0.5		Lean CLAY; very stiff, slightly moist, plastic, fine sand, dark brown, (CL).	S SSS	18	--							
			A	--	--							
			C SSS	18	--							
			K									
3.5		Sandy SILT; hard, slightly moist, nonplastic, medium to fine sand, weakly cemented, strongly cemented below 4.5 feet, caliche, white-pink, (ML).	SSS	36	--							
5.0			SSS	55	--							
9		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 10" in diameter, subrounded, coarse to fine sand, light brown,. (GP).										
			SSS	100/.4	--							
10.4												

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
HOLE NO. DH-3
SHEET 1 OF 1
JOB NO.: 86-1357
LOCATION See Drawing No. 86-1357-1
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
ELEVATION: TOP OF HOLE 2866.5'
DRILLED BY: D. Rose
GROUNDWATER None
LOGGED BY: M. Petaja
DATE: HOLE STARTED 5/14/86
REMARKS:
HOLE COMPLETED 5/14/86



DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Poorly Graded GRAVEL with Sand; medium dense, crushed minus 3/4".	BAG	--	--							
1.0		Lean CLAY; stiff, slightly moist, plastic, cemented particles below 1.3', dark brown, (CL).	SSS	46	--							
1.7		Sandy SILT; hard, slightly moist, nonplastic, medium to fine sand, strongly cemented, white-pink, caliche, (ML).	SSS	83/.8	--							
4.4		Poorly Graded GRAVEL with Sand; very dense, slightly moist, subrounded to subangular, coarse to fine sand, scattered cobbles to 10" in diameter below 6.0 feet, brown, (GP).	SSS	54	--							
9.5			SSS	50/.3	--							
10.3		Bottom of Hole										

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
HOLE NO. DH-4
SHEET 1 OF 1
JOB NO.: 86-1357
LOCATION See Drawing No. 86-1357-1
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
ELEVATION: TOP OF HOLE 2866.7
DRILLED BY: D. Rose
GROUNDWATER None
LOGGED BY: M. Petaja
DATE: HOLE STARTED 5/14/86
REMARKS:
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Poorly Graded GRAVEL with Sand and Cobbles; medium dense, cobbles to 6" diameter, subrounded										
0.9		Lean CLAY; very stiff, slightly moist, plastic, dark brown, (CL).	STS	--	--							
2.4		Sandy SILT; hard, slightly moist, nonplastic, medium to fine sand, strongly cemented, white-pink, caliche, (ML).	SSS	105	16							
4.5												
			SSS	46	--							
		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 10" diameter, subrounded, coarse to fine sand, brown, (GP).										
9												
			SSS	50/.3	--							
10.3		Bottom of Hole										

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
HOLE NO. DH-5
SHEET 1 OF 1
JOB NO.: 86-1357
LOCATION See Drawing No. 86-1357-1
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
ELEVATION: TOP OF HOLE 2867.3'
DRILLED BY: D. Rose
GROUNDWATER None
LOGGED BY: M. Petaja
DATE: HOLE STARTED 5/14/86
REMARKS:
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Well Graded GRAVEL with Silt, Sand, and Cobbles; loose, nonplastic, cobbles to 12" in diameter, subrounded and angular.	SSS	4	--							
1.0		FILL: Clayey GRAVEL with Sand; loose, moist, plastic fines, maximum size 1-1/2" fragments of cemented soils.	SSS	6	--							
3.0		Lean CLAY; hard, moist, plastic, dark brown, (CL).	SSS	42	26							
4.0		Sandy SILT; hard, slightly moist, nonplastic, strongly cemented, medium to fine sand, white-pink, caliche, (ML).	SSS	113/.9	--							
5.6		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 10" diameter, subrounded, medium to fine sand, light brown, (GP).										
9			SSS	68/.5	--							
10.5		Bottom of Hole										

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
JOB NO.: 86-1357
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
DRILLED BY: D. Rose
LOGGED BY: M. Petaja
REMARKS:

HOLE NO. DH-6
SHEET 1 OF 1
LOCATION See Drawing No. 86-1357-
ELEVATION: TOP OF HOLE 2863.5'
GROUNDWATER None
DATE: HOLE STARTED 5/14/86
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Well Graded GRAVEL with Sand; loose, crushed minus 3/4".	BAG	--	---							
0.2		FILL: Clayey GRAVEL with Sand; loose, slightly moist, plastic, subrounded, maximum size 3" diameter, medium to fine sand, organics.	BAG	--	---							
1.5		Lean CLAY; stiff, slightly moist, plastic, brown, (CL).	STS	--	21							
3.3		Sandy SILT; hard, slightly moist nonplastic, strongly cemented, fine sand, white, caliche, (ML).	SSS	74	---							
5		NOTE: A thin zone of fill material was found at 4.5 to 5.0 feet. The fill consisted of sandy SILT with organics, moderately plastic, coarse to fine sand. It is speculated that this was part of an old trench and the sample went through a undercut trench wall. More extensive drilling would be required to further define it.	SSS	95/.9	---							
9.0		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 6" diameter, subrounded, medium to fine sand, brown, (GP).	SSS	50/.2	---							
9.7		Bottom of Hole										

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
JOB NO.: 86-1357
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
DRILLED BY: D. Rose
LOGGED BY: M. Petaja
REMARKS:

HOLE NO. DH-7
SHEET 1 OF 1
LOCATION See Drawing No. 86-1357-1
ELEVATION: TOP OF HOLE 2863.8'
GROUNDWATER None
DATE: HOLE STARTED 5/14/86
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Poorly Graded GRAVEL with Sand; loose, subrounded to angular, maximum size 3" diameter.										
0.7		FILL: SILT with Sand; stiff, nonplastic, roots, organics, coarse to fine sand, scattered gravels, dark gray.	S									
			B S	9	--							
			A									
			G S	--	25							
			S									
			S									
			S S	10	24							
3.0		Lean CLAY; stiff, moist, plastic, brown, (CL).	T S	--	28							
			S									
4.2		Silty SAND; hard, slightly moist, nonplastic, strongly cemented, white-pink, caliche, (ML).	SSS	85/.8	26							
5.8		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 8" diameter, subrounded, coarse to fine sand, brown, (GP).										
9												
9.5		Poorly Graded SAND; dense, slightly moist, scattered subround gravels to 1" diameter, medium to fine, brown to white, (SP).	SSS	20	--							
11.0												

Bottom of Hole

Northern
Engineering
and Testing, Inc.

LOG OF EXPLORATION BORING

PROJECT: BLM Warehouse and Maintenance Building; Boise, Idaho
JOB NO.: 86-1357
DRILL TYPE: SOIL CME-75 with 7" hollowstem auger
ROCK N/A
DRILLED BY: D. Rose
LOGGED BY: M. Petaja
REMARKS:

HOLE NO. DH- 8
SHEET 1 OF 1
LOCATION: See Drawing No. 86-1357-1
ELEVATION: TOP OF HOLE 2864.1'
GROUNDWATER None
DATE: HOLE STARTED 5/14/86
HOLE COMPLETED 5/14/86

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0.0		FILL: Clayey GRAVEL with Sand; medium dense, slightly moist, plastic, subround, maximum size 3" diameter.	SSS	24	--							
1.3		Silty CLAY; very stiff, slightly moist, moderately plastic, coarse to fine sand, roots, light to dark brown, (CL-ML).	SSS	16	19	--	25	6	0	13	87	
4.5			SSS	91/.9	--							
		Poorly Graded GRAVEL with Sand and Cobbles; very dense, slightly moist, cobbles to 8" diameter, subround, coarse to fine sand, brown, highly permeable, (GP).										
9												
			SSS	65	--							
11.0												

Bottom of Hole

Northern
Engineering
and Testing, Inc.

GRAIN SIZE DISTRIBUTION CURVE

Project: BLM Warehouse and Maintenance Bldg. Boise, Idaho

Location: DH 1 0.4 - 0.8 feet

Job No. 86-1357

Classification Lean Clay

Date 5/20/86

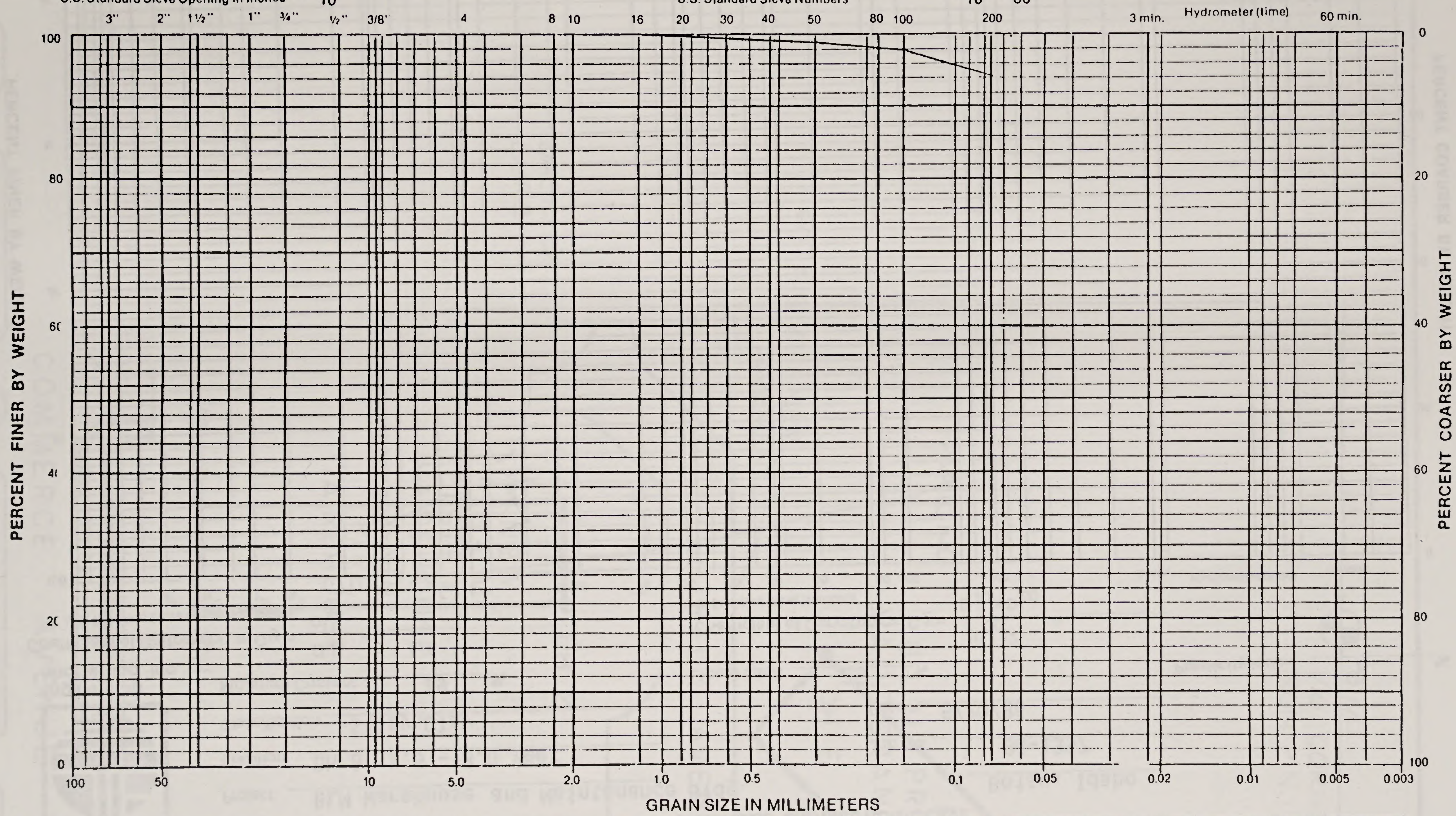
Moisture Content 23 %

Liquid Limit 35 %

Plasticity Index 18 %

Coefficient of Uniformity $= C_U = \frac{D_{60}}{D_{10}} =$ ______

Coefficient of Curvature $= C_Z = \frac{(D_{30})^2}{D_{10} \times D_{60}} =$ ______



Gravel		Sand			Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

PLATE NO. 1

NET-105

Northern

Engineering
and Testing, Inc.

GRAIN SIZE DISTRIBUTION CURVE

Project: BLM Warehouse and Maintenance Bldg. Boise, Idaho

Location: DH 8 1.5 - 3.0 feet

Job No. 86-1357

Classification Silty Clay

Date 5/20/86

Moisture Content 19 %

Liquid Limit 25 %

Plasticity Index 6 %

Coefficient of Uniformity $= C_U = \frac{D_{60}}{D_{10}} =$ ______

Coefficient of Curvature $= C_Z = \frac{(D_{30})^2}{D_{10} \times D_{60}} =$ ______

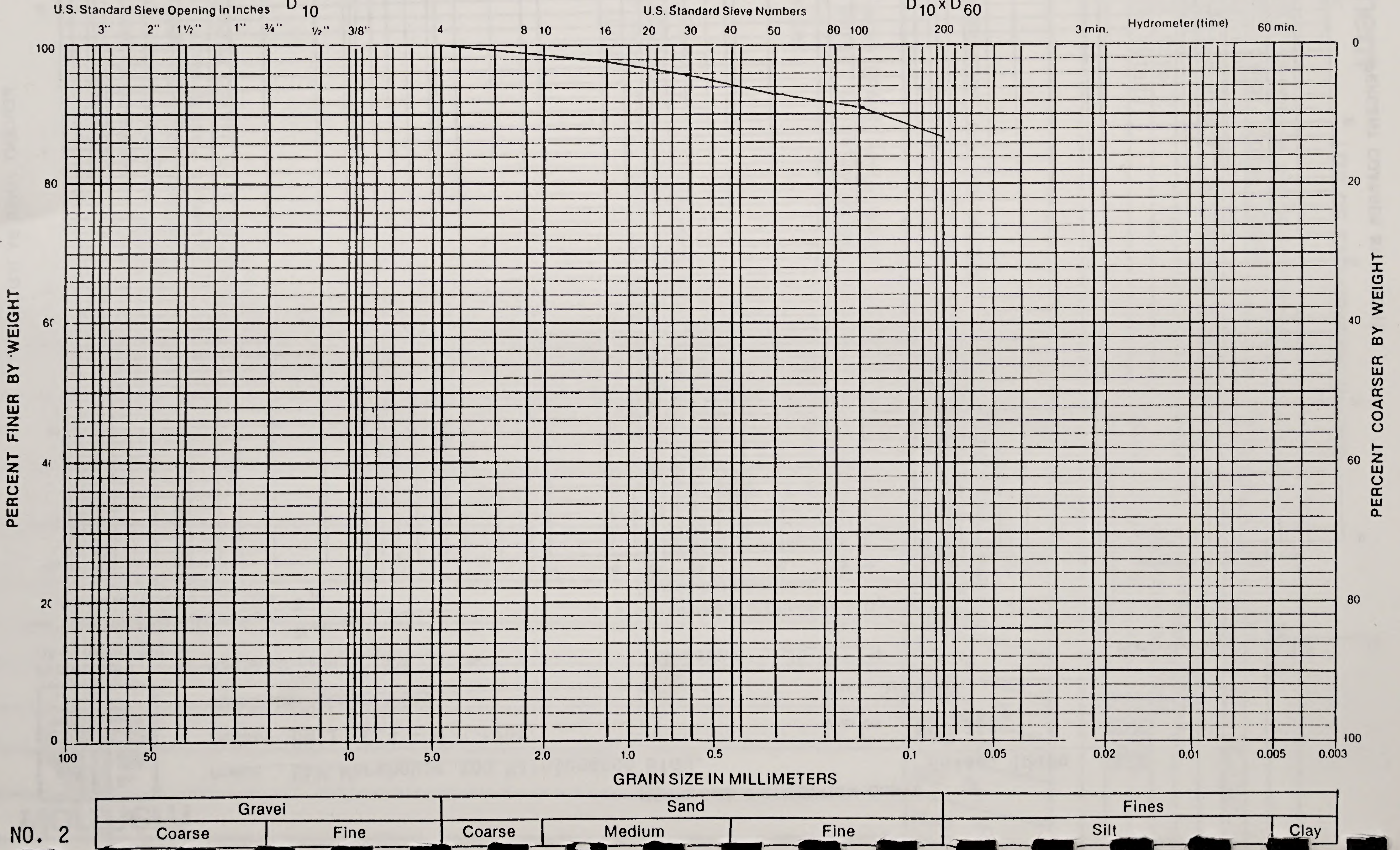
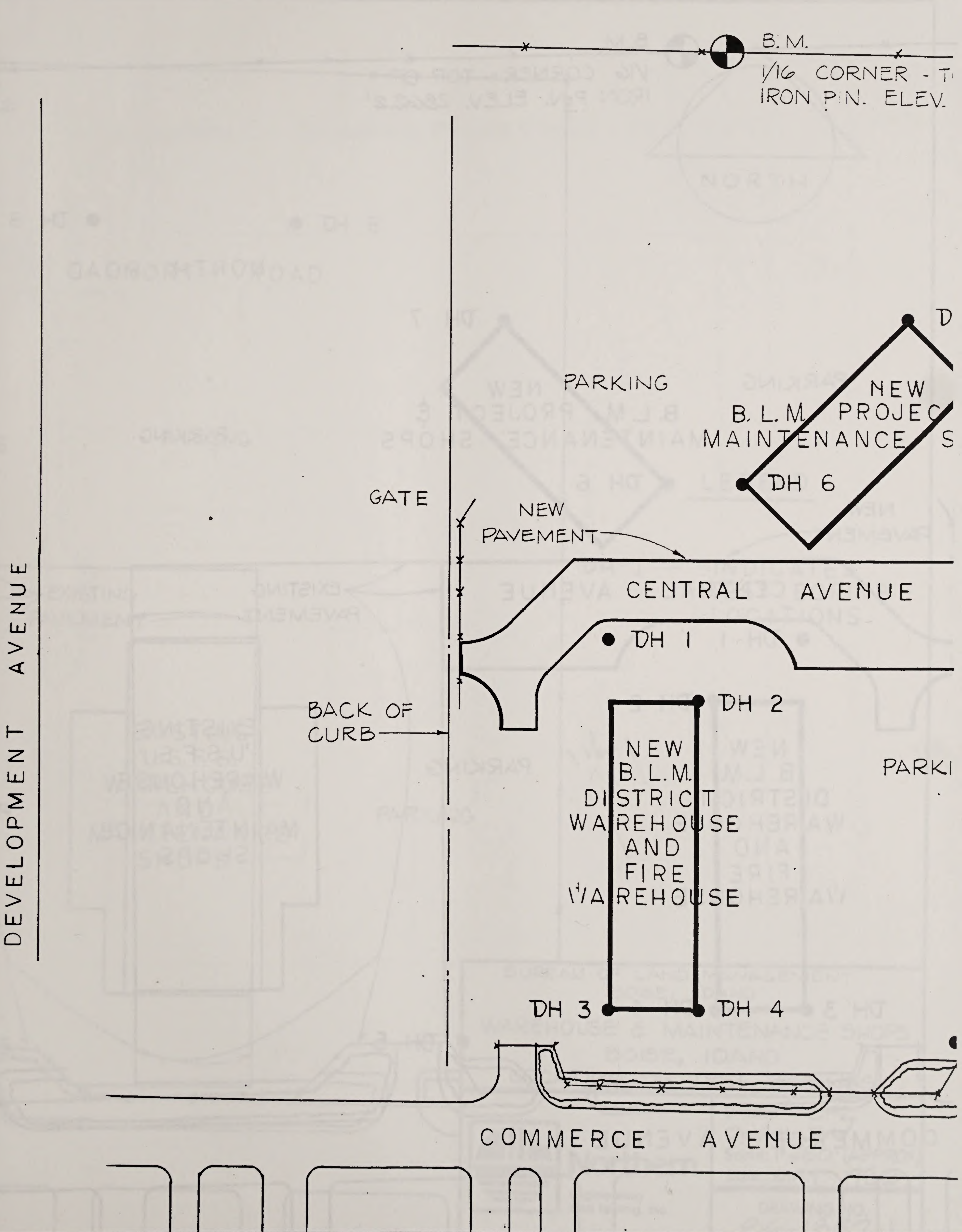
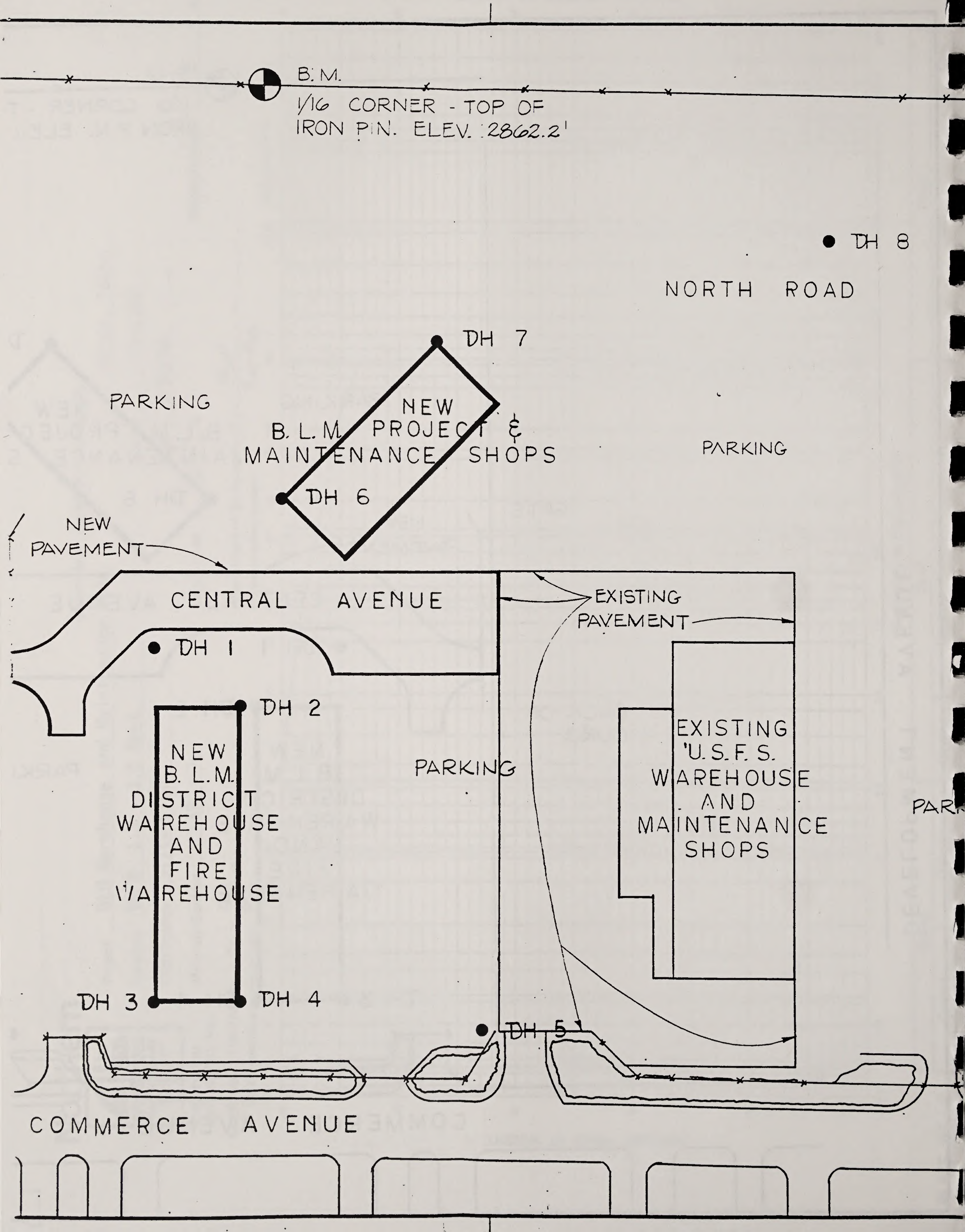
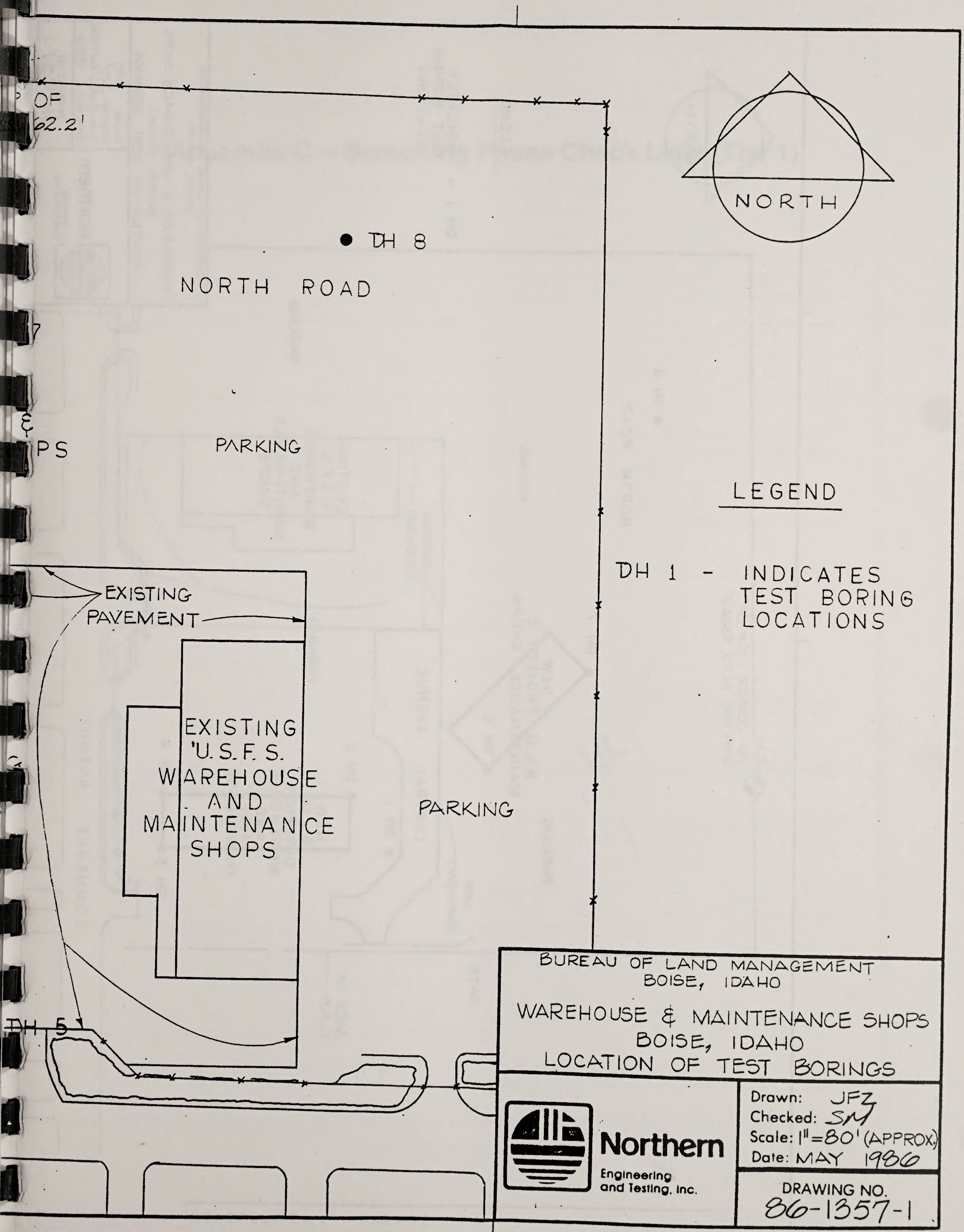


PLATE NO. 2


B. M.
1/16 CORNER - T
IRON PIN. ELEV.
DEVELOPMENT AVENUE
PARKING
NEW B. L. M. PROJEC MAINTENANCE S
D
DH 6
GATE
NEW PAVEMENT
CENTRAL AVENUE
DH 1
DH 2
BACK OF CURB
NEW B. L. M. DISTRICT WAREHOUSE AND FIRE WAREHOUSE
PARKI
DH 3
DH 4
COMMERCE AVENUE


B. M.
1/16 CORNER - TOP OF
IRON PIN. ELEV. 2862.2'
DH 8
NORTH ROAD
DH 7
PARKING
NEW
B. L. M. PROJECT &
MAINTENANCE SHOPS
PARKING
DH 6
NEW
PAVEMENT
CENTRAL AVENUE
EXISTING
PAVEMENT
DH 1
DH 2
NEW
B. L. M.
DISTRICT
WAREHOUSE
AND
FIRE
WAREHOUSE
PARKING
EXISTING
U. S. F. S.
WAREHOUSE
AND
MAINTENANCE
SHOPS
PAR
DH 3
DH 4
DH 5
COMMERCE AVENUE



LEGEND

DH 1 - INDICATES TEST BORING LOCATIONS

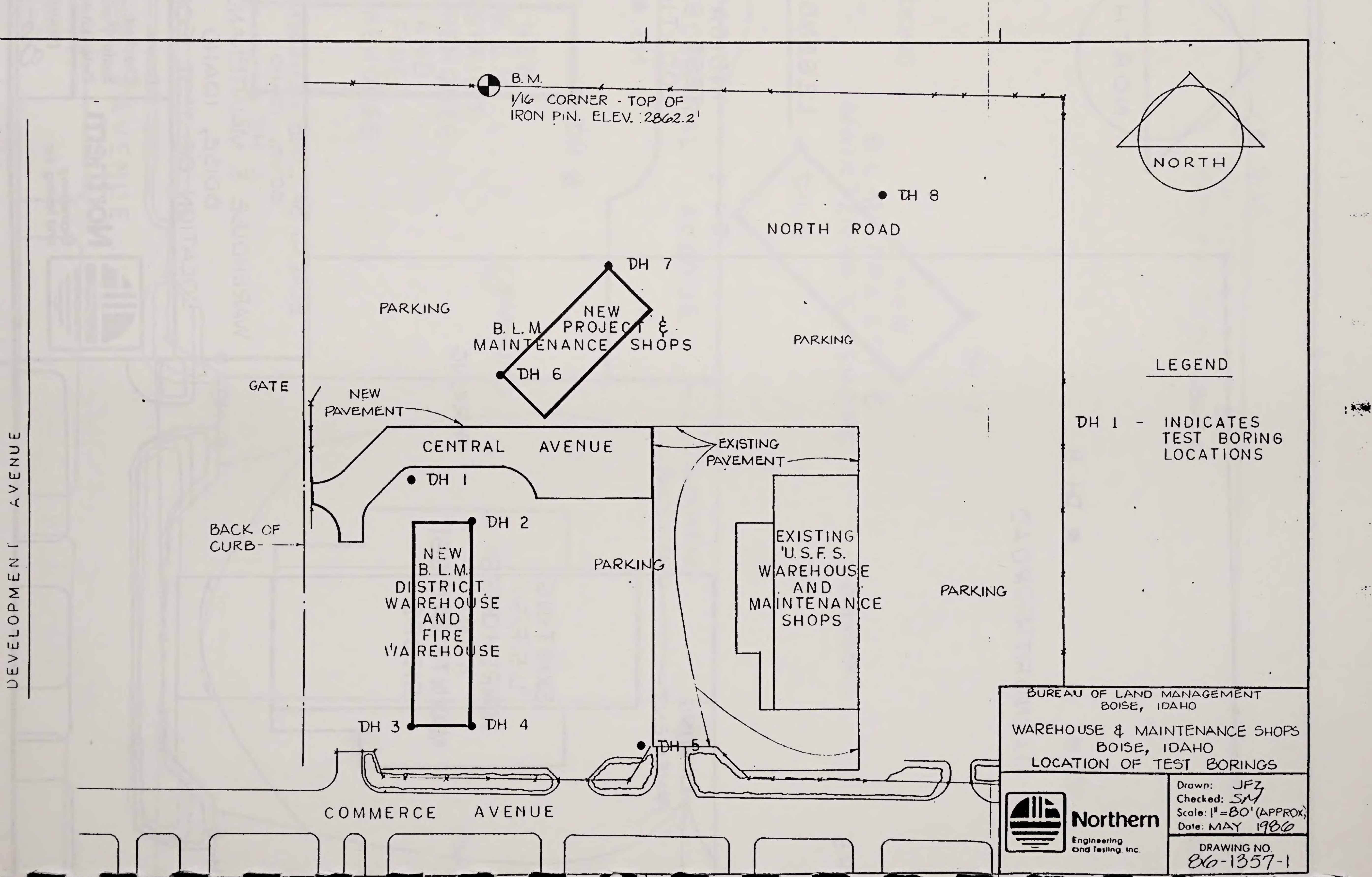
BUREAU OF LAND MANAGEMENT
BOISE, IDAHO

WAREHOUSE & MAINTENANCE SHOPS
BOISE, IDAHO
LOCATION OF TEST BORINGS

Northern
Engineering
and Testing, Inc.

Drawn: JFZ
Checked: SM
Scale: 1"=80' (APPROX.)
Date: MAY 1986

DRAWING NO.
86-1357-1



LEGEND

DH 1 - INDICATES TEST BORING LOCATIONS

BUREAU OF LAND MANAGEMENT
BOISE, IDAHO

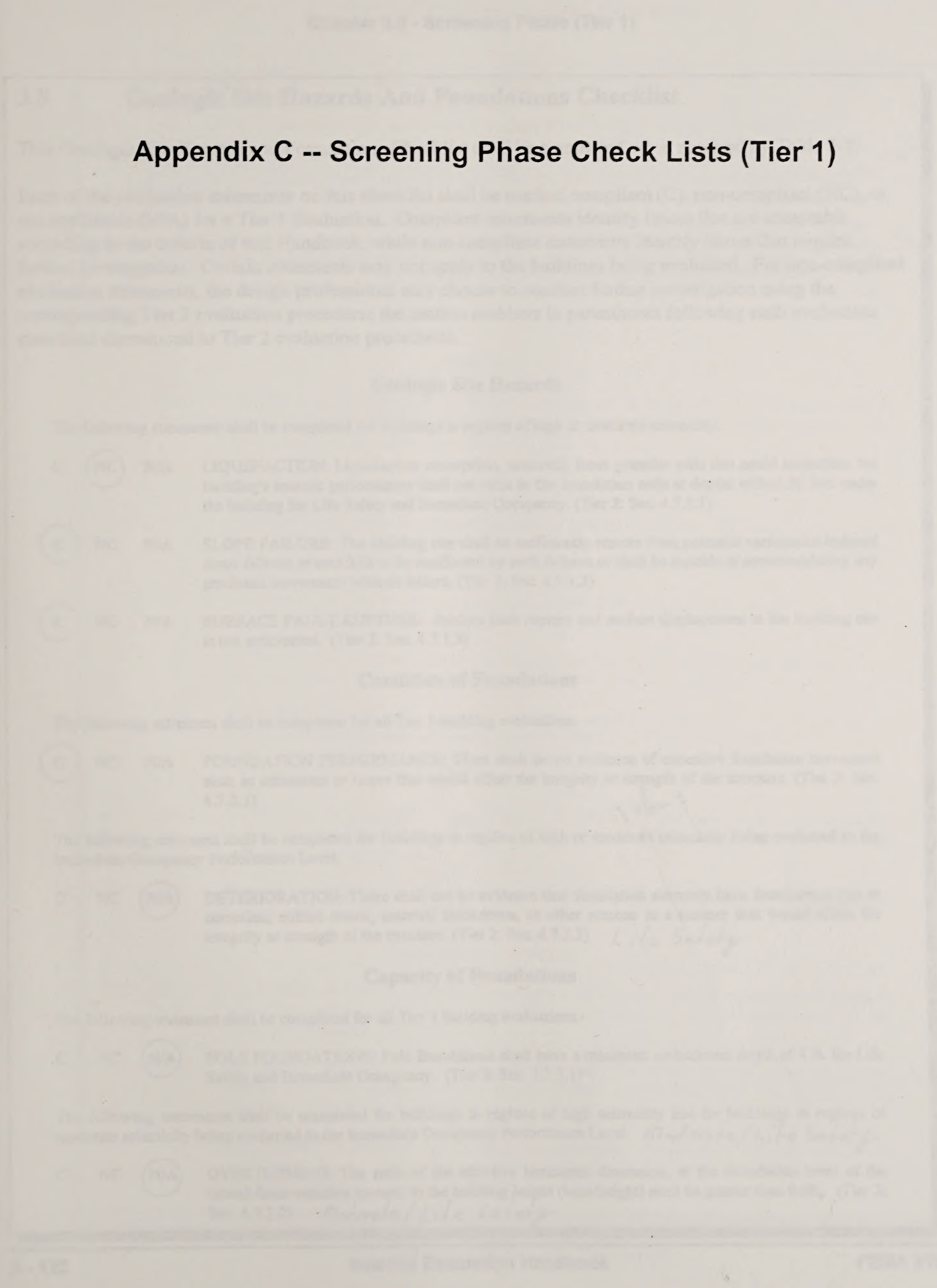
WAREHOUSE & MAINTENANCE SHOPS
BOISE, IDAHO
LOCATION OF TEST BORINGS

Northern
Engineering and Testing Inc.

Drawn: JFZ
Checked: SM
Scale: 1" = 80' (APPROX.)
Date: MAY 1986

DRAWING NO.
86-1357-1

Appendix C -- Screening Phase Check Lists (Tier 1)



3.8 Geologic Site Hazards And Foundations Checklist

This Geologic Site Hazards and Foundations Checklist shall be completed when required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked compliant (C), non-compliant (NC), or not applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this Handbook, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 evaluation procedure; the section numbers in parentheses following each evaluation statement correspond to Tier 2 evaluation procedures.

Geologic Site Hazards

The following statements shall be completed for buildings in regions of high or moderate seismicity.

C [✓ NC] N/A LIQUEFACTION: Liquefaction susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)

[✓ C] NC N/A SLOPE FAILURE: The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)

[✓ C] NC N/A SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)

Condition of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

[✓ C] NC N/A FOUNDATION PERFORMANCE: There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)

The following statement shall be completed for buildings in regions of high or moderate seismicity being evaluated to the Immediate Occupancy Performance Level.

C NC [✓ N/A] DETERIORATION: There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2) Life Safety

Capacity of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC [✓ N/A] POLE FOUNDATIONS: Pole foundations shall have a minimum embedment depth of 4 ft. for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)

The following statements shall be completed for buildings in regions of high seismicity and for buildings in regions of moderate seismicity being evaluated to the Immediate Occupancy Performance Level. Moderate/Life Safety

C NC [✓ N/A] OVERTURNING: The ratio of the effective horizontal dimension, at the foundation level of the lateral-force-resisting system, to the building height (base/height) shall be greater than $0.6S_a$. (Tier 2: Sec. 4.7.3.2) Moderate/Life Safety

C NC [✓ N/A] TIES BETWEEN FOUNDATION ELEMENTS: The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Tier 2: Sec. 4.7.3.3)

C NC [✓ N/A] DEEP FOUNDATIONS: Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)

C NC [✓ N/A] SLOPING SITES: The grade difference from one side of the building to another shall not exceed one-half the story height at the location of embedment. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5) Life Safety

3.9.1 Basic Nonstructural Component Checklist

This Basic Nonstructural Component Checklist shall be completed when required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked compliant (C), non-compliant (NC), or not applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this Handbook, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 evaluation procedure; the section numbers in parentheses following each evaluation statement correspond to Tier 2 evaluation procedures.

Partitions

C NC [✓ N/A] UNREINFORCED MASONRY: Unreinforced masonry or hollow clay tile partitions shall be braced at a spacing of equal to or less than 10 feet in regions of low and moderate seismicity and 6 feet in regions of high seismicity. (Tier 2: Sec. 4.8.1.1)

Ceiling Systems

[✓ C] NC N/A INTEGRATED CEILINGS: Integrated suspended ceilings at exits and corridors or weighing more than 2 lb/ft^2 shall be laterally restrained with a minimum of 4 diagonal wires or rigid members attached to the structure above at a spacing of equal to or less than 12 ft. (Tier 2: Sec. 4.8.2.1)

C [✓ NC] N/A LAY-IN TILES: Lay-in tiles used in ceiling panels located at exitways and corridors shall be secured with clips. (Tier 2: Sec. 4.8.2.2)

C [✓ NC] N/A SUPPORT: The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions. (Tier 2: Sec. 4.8.2.3)

C NC [✓ N/A] SUSPENDED LATH AND PLASTER: Ceilings consisting of suspended lath and plaster or gypsum board shall be attached for each 10 square feet of area. (Tier 2: Sec. 4.8.2.4)

Light Fixtures

C [✓ NC] N/A INDEPENDENT SUPPORT: Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures. (Tier 2: Sec. 4.8.3.1)

[✓ C] NC N/A EMERGENCY LIGHTING: Emergency lighting shall be anchored or braced to prevent falling or swaying during an earthquake. (Tier 2: Sec. 4.8.3.2)

Cladding and Glazing

C NC [✓ N/A] CLADDING ANCHORS: Cladding components weighing more than 10 psf shall be anchored to the exterior wall framing at a spacing equal to or less than 6 ft. for Life Safety and 4 ft. for Immediate Occupancy. (Tier 2: Sec. 4.8.4.1)

C NC [✓ N/A] CLADDING ISOLATION: For moment frame buildings of steel or concrete, panel connections shall be detailed to accommodate a drift ratio of 0.02 for Life Safety and 0.01 for Immediate Occupancy. (Tier 2: Sec. 4.8.4.2)

C NC [✓ N/A] MULITSTORY PANELS: For multistory panels attached at each floor level, the panels and connections shall be able to accommodate a drift ratio of 0.02 for Life Safety and 0.01 for Immediate Occupancy. (Tier 2: Sec. 4.8.4.3)

C NC [✓ N/A] BEARING CONNECTIONS: Where bearing connections are required, there shall be a minimum of two bearing connections for each wall panel. (Tier 2: Sec. 4.8.4.4)

C NC [✓ N/A] INSERTS: Where inserts are used in concrete connections, the inserts shall be anchored to reinforcing steel. (Tier 2: Sec. 4.8.4.5)

C NC [✓ N/A] PANEL CONNECTIONS: Exterior cladding panels shall be anchored with a minimum of 2 connections for each wall panel for Life Safety and 4 connections for Immediate Occupancy. (Tier 2: Sec. 4.8.4.6)

C NC [✓ N/A] DETERIORATION: There shall be no evidence of deterioration or corroding in any of the connection elements. (Tier 2: Sec. 4.8.4.7)

C NC [✓ N/A] DAMAGE: There shall be no damage to exterior wall cladding. (Tier 2: Sec. 4.8.4.8)

C [✓ NC] N/A GLAZING: Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface, shall be laminated annealed or heat strengthened safety glass that will remain in the frame when cracked. (Tier 2: Sec. 4.8.4.9)

Masonry Veneer

C [✓ NC] N/A SHELF ANGLES: Masonry veneer shall be supported by shelf angles or other elements at each floor above the first floor. (Tier 2: Sec. 4.8.5.1)

C [✓ NC] N/A TIES: Masonry veneer shall be connected to the back-up with corrosion-resistant ties. The ties shall have a spacing of equal to or less than 36" for Life Safety and 24" for Immediate Occupancy with a minimum of one tie for every 2-2/3 square feet. (Tier 2: Sec. 4.8.5.2)

C [✓ NC] N/A WEAKENED PLANES: Masonry veneer shall be anchored to the back-up at locations of flashing. (Tier 2: Sec. 4.8.5.3)

Parapets, Cornices, Ornamentation and Appendages

C NC [✓ N/A] URM PARAPETS: There shall be no laterally unsupported unreinforced masonry parapets or cornices above the highest anchorage level with height-to-thickness ratios greater than 1.5 in regions of high seismicity and 2.5 in regions of moderate or low seismicity. (Tier 2: Sec. 4.8.8.1)

[✓ C] NC N/A CANOPIES: Canopies located at building exits shall be anchored at a spacing 10 feet for Life Safety and 6 feet for Immediate Occupancy. (Tier 2: Sec. 4.8.8.2)

Masonry Chimneys

C NC [✓ N/A] URM: No unreinforced masonry chimney shall extend above the roof surface more than twice the least dimension of the chimney. (Tier 2: Sec. 4.8.9.1)

C NC [✓ N/A] MASONRY: Masonry chimneys shall be anchored to the floor and roof. (Tier 2: Sec. 4.8.9.2)

Stairs

[✓ C] NC N/A URM WALLS: Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry. (Tier 2: Sec. 4.8.10.1)

C NC [✓ N/A] STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure shall not rely on shallow anchors in concrete. Alternatively, the stair details shall be capable of accommodating the drift calculated using the Quick Check Procedure of Section 3.5.3.1 without inducing tension in the anchors. (Tier 2: Sec. 4.8.10.2)

Building Contents and Furnishing

C [✓ NC] N/A TALL NARROW CONTENTS: Contents with a height-to-depth ratio greater than 3 for Immediate Occupancy and 4 for Life Safety shall be anchored to the floor slab or adjacent walls. (Tier 2: Sec. 4.8.11.1)

Mechanical and Electrical Equipment

C NC [✓ N/A] EMERGENCY POWER: Equipment used as part of an emergency power system shall be mounted to maintain continued operation after an earthquake. (Tier 2: Sec. 4.8.12.1)

C NC [✓ N/A] HEAVY EQUIPMENT: Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 ft. above the floor level shall be braced. (Tier 2: Sec. 4.8.12.2)

Piping

C NC [✓ N/A] FIRE SUPPRESSION PIPING: Fire suppression piping shall be anchored and braced in accordance with *NFPA-13* (NFPA, 1996). This statement need not be evaluated for buildings in regions of moderate seismicity being evaluated to the Life Safety Performance Level. (Tier 2: Sec. 4.8.13.1)

C NC [✓ N/A] FLEXIBLE COUPLINGS: Fluid, gas and fire suppression piping shall have flexible couplings. This statement need not be evaluated for buildings in regions of moderate seismicity being evaluated to the Life Safety Performance Level. (Tier 2: Sec. 4.8.13.2)

Hazardous Materials Storage and Distribution

C NC [✓ N/A] TOXIC SUBSTANCES: Toxic and hazardous substances stored in breakable containers shall be restrained from falling by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 4.8.15.1)

3.7.4 Basic Structural Checklist For Building Type S2: Steel Braced Frames With Stiff Diaphragms

This Basic Structural Checklist shall be completed when required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked compliant (C), non-compliant (NC), or not applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this Handbook, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 evaluation procedure; the section numbers in parentheses following each evaluation statement correspond to Tier 2 evaluation procedures.

Commentary:

These buildings consist of a frame assembly of steel beams and steel columns. Floor and roof framing consists of cast-in-place concrete slabs or metal deck with concrete fill supported on steel beams, open web joists or steel trusses. Lateral forces are resisted by tension and compression forces in diagonal steel members. When diagonal brace connections are concentric to beam column joints, all member stresses are primarily axial. When diagonal brace connections are eccentric to the joints, members are subjected to bending and axial stresses. Diaphragms consist of concrete or metal deck with concrete fill and are stiff relative to the frames. When the exterior of the structure is concealed, walls consist of metal panel curtain walls, glazing, brick masonry, or precast concrete panels. When the interior of the structure is finished, frames are concealed by ceilings, partition walls and architectural furring. Foundations consist of concrete spread footings or deep pile foundations.

Building System

[✓ C] NC N/A LOAD PATH: The structure shall contain one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)

C NC [✓ N/A] MEZZANINES: Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)

C [✓ NC] N/A WEAK STORY: The strength of the lateral-force-resisting system in any story shall not be less than 80% of the strength in an adjacent story above or below for Life-Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)

[✓ C] NC N/A SOFT STORY: The stiffness of the lateral-force-resisting system in any story shall not be less than 70% of the stiffness in an adjacent story above or below or less than 80% of the average stiffness of the three stories above or below for Life-Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)

[✓ C] NC N/A GEOMETRY: There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30% in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses. (Tier 2: Sec. 4.3.2.3)

[✓ C] NC N/A VERTICAL DISCONTINUITIES: All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)

[✓ C] NC N/A MASS: There shall be no change in effective mass more than 50% from one story to the next for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.5)

[✓ C] NC N/A TORSION: The distance between the story center of mass and the story center of rigidity shall be less than 20% of the building width in either plan dimension for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.6)

[✓ C] NC N/A DETERIORATION OF STEEL: There shall be no visible rusting, corrosion, cracking or other deterioration in any of the steel elements or connections in the vertical- or lateral-force-resisting systems. (Tier 2: Sec. 4.3.3.3)

[✓ C] NC N/A DETERIORATION OF CONCRETE: There shall be no visible deterioration of concrete or reinforcing steel in any of the vertical- or lateral-force-resisting elements. (Tier 2: Sec. 4.3.3.4)

Lateral Force Resisting System

C [✓ NC] N/A AXIAL STRESS CHECK: The axial stress due to gravity loads in columns subjected to overturning forces shall be less than $0.10F_y$ for Life Safety and Immediate Occupancy. Alternatively, the axial stress due to overturning forces alone, calculated using the Quick Check Procedure of Section 3.5.3.6, shall be less than $0.30F_y$ for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.1.3.2)

C [✓ NC] N/A REDUNDANCY: The number of lines of braced frames in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. The number of braced bays in each line shall be greater than 2 for Life Safety and 3 for Immediate Occupancy. (Tier 2: Sec. 4.4.3.1.1)

[✓ C] NC N/A AXIAL STRESS CHECK: The axial stress in the diagonals, calculated using the Quick Check procedure of Section 3.5.3.4, shall be less than 18 ksi or $0.50F_y$ for Life Safety and for Immediate Occupancy. (Tier 2: Sec. 4.4.3.1.2)

C NC [✓ N/A] COLUMN SPLICES: All column splice details located in braced frames shall develop the tensile strength of the column. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.3.1.5)

Connections

[✓ C] NC N/A TRANSFER TO STEEL FRAMES: Diaphragms shall be connected for transfer of loads to the steel frames for Life Safety and the connections shall be able to develop the shear strength of the frames for Immediate Occupancy. (Tier 2: Sec. 4.6.2.2)

[✓ C] NC N/A STEEL COLUMNS: The columns in lateral-force-resisting frames shall be anchored to the building foundation for Life Safety and the anchorage shall be able to develop the tensile capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.1)

Appendix D -- Screening Phase Calculations (Tier 1)

(Partition Length Calculations Excel File BOISDOPT.XLS)

(Weight Calculations Excel File BOISDOWT.XLS)

PARTITION LENGTHS

Building Section 1 Partitions

2 thru 6 Lines; D-G Lines; N-S Partitions

Location	Section Length	Number	Length (ft)	
3 Line	56	1	56	
3+ Line	26	1	26	
3+ Line	12	1	12	
4, 4+ Line	26	1	26	
			120	ft

2 thru 6 Lines; D-G Lines; E-W Partitions

Location	Section Length	Number	Length (ft)	
E; F-; F Lines	30	3	90	ft

PARTITION LENGTHS

Building Section 2 Partitions - Second Floor

2 thru 7 Lines; C-D Lines; N-S Partitions

Location	Section Length	Number	Length (ft)	
Secure Storage	40	1	40	
2; 2+; 3	19	9	171	
			211	ft

2 thru 7 Lines; C-D Lines; E-W Partitions

Location	Section Length	Number	Length (ft)	
C; C+; Corridor	84	2	168	
3-	11	1	11	
D-	17	1	17	
			196	ft

5 thru 9 Lines; A-B Lines; N-S Partitions

Location	Section Length	Number	Length (ft)	
Chase	51	1	51	
5; 6; 7; 8; 8+	21	5	105	
5- (Tele)	16	1	16	
7+ Line	14	1	14	
			186	ft

5 thru 9 Lines; A-B Lines; E-W Partitions

Location	Section Length	Number	Length (ft)	
5-	5	3	15	
A+ (Corridor)	60	2	120	
B (Conference)	31	1	31	
B Line	12	1	12	
			178	ft

PARTITION LENGTHS

Building Section 2 Partitions - First Floor

1 thru 9 Lines; A-B Lines; N-S Partitions

Location	Section Length	Number	Length (ft)	
1+ Line	15	1	15	
2;3;5-;5+	26	5	130	
2+	9	1	9	
6	16	1	16	
9-	15	1	15	
			185	ft

1 thru 9 Lines; A-B Lines; E-W Partitions

Location	Section Length	Number	Length (ft)	
1-2 Lines	13	1	13	
1-2 Lines	12	1	12	
2+	16	1	16	
5-	11	1	11	
5+	12	1	12	
2 thru 5 Lines	73	1	73	
8 thru 9 Lines	13	1	13	
			150	ft

1 thru 9 Lines; C-D Lines; N-S Partitions

Location	Section Length	Number	Length (ft)	
2;2+;3;3+;4;4+;5(2);5+,6	20	11	220	ft

1 thru 9 Lines; C-D Lines; E-W Partitions

Location	Section Length	Number	Length (ft)	
C & D Line	85	2	170	
	10	1	10	
	21	1	21	
	18	1	18	
			219	ft

STRUCTURE WEIGHTS

Weight of Building Section 1 (One Story Portion of Building)

(Seismic Weight Attributed to the Roof Diaphragm)

Roof

Material	Unit Weight (psf)	Length (ft)	Width (ft)	Area (ft^2)	Weight (lbs)	Part Subtotal (lbs)
1 1/2" x 18 ga. deck	2.7	88.7	55.5	4,923	13,292	
4" Rigid Board Insul.	6.0	88.7	55.5	4,923	29,537	
Built up Roof	6.5	88.7	55.5	4,923	31,999	
Acoustical Tile below	1.5	88.7	55.5	4,923	7,384	
Lights, HVAC, etc.	5.0	88.7	55.5	4,923	24,614	
						106,826

Roof Beams

Location	Member Size	Unit Weight (plf)	Length (ft)	Number	Weight (lbs)	
E-line	W14x22	22	24	1	528	
E-line	W14x22	22	12	1	264	
E-line	M12x11.8	11.8	24	1	283	
E-line	W16x26	26	24	1	624	
F-line	W14x22	22	24	1	528	
F-line	M12x11.8	11.8	24	2	566	
F-line	W14x22	22	12	1	264	
G-line	W14x22	22	24	3	1,584	
2-line	W16x31	31	24	1	744	
2-line	W14x22	22	24	1	528	
2 thru 5-line	W14x26	26	8	4	832	
3 & 4-line	W14x22	22	24	4	2,112	
5-line	W14x22	22	24	2	1,056	
6-line	W14x22	22	24	1	528	
6-line	M8x6.5	6.5	8	1	52	
Intermediate	M12x11.8	11.8	24	8	2,266	
Ledgers @ 2 & 6+	W10x15	15	12	2	360	
Ledgers @ 2	W14x22	22	24	1	528	
Ledgers @ G	W10x15	15	24	3	1,080	
Skylight framing	W16x26	26	21.3	1	554	
Skylight framing	M12x11.8	11.8	24	6	1,699	
Skylight framing	M12x11.8	11.8	14.7	1	173	
Skylight framing	W24x55	55	24	3	3,960	
						21,114

Seismic Dead Weight of Roof Contributing to Roof Diaphragm of Building Section 1 **127,940 lbs**

Say 130,000 lbs

STRUCTURE WEIGHTS

Weight of Building Section 1 (One Story Portion of Building)

(Seismic Weight Attributed to the Roof Diaphragm)

Columns	Member Size	Unit Weight (plf)	Length (ft)	Number	Weight (lbs)	
1/2 of Column Height Below Roof	5" Std. pipe	14.6	6.9	15	1,511	
1/2 of Brace Length Below Roof	4" Std. Pipe	10.79	18.3	8	1,580	
						3,091

Unit Weight of Exterior Walls	Unit Weight (psf)
4" Brick	40.0
1/2" Plywood	1.5
6" Steel Studs @ 24"	1.0
6" Batt Insulation	2.4
5/8" Gyp. Brd (One Side)	2.5
	47.4

Notes for Wall and Column Weight Calculations

1. Neglect window area. Assume the entire wall is typical construction. This will be conservative. Windows are small and do not cover a large area of the wall. Increased weight determined by this assumption will be used to account for brick pavers (window sills) which are not included in estimate.

2. Column & wall weights are based on assumption that 1/2 of story height below the roof contributes to the seismic weight at the roof level. 2' added to height to account for parapet.

Walls

	Location	Length (ft)	Height (ft)	Area (sf)	Unit Weight (psf)	Weight (lbs)	Subtotal (lbs)
Total Area of Exterior Walls	G-line	74.7	8.9	665	47.4	31,513	
	2-line	55.5	8.9	494	47.4	23,413	
	5-line	26.0	8.9	231	47.4	10,968	
	6-line	31.0	8.9	276	47.4	13,078	
							78,972

Seismic Dead Weight of Walls Contributing to Roof Diaphragm of Building Section 1 **82,063 lbs**

Say 85,000 lbs

STRUCTURE WEIGHTS

Weight of Partitions Contributing to Roof Diaphragm of Building Section 1

Unit Weight of 2X4 metal stud wall with gypsum board each side = 6 psf

Assume that all partitions are full height from top of lower slab to bottom of deck above. This is conservative, not all partition walls are full height.

One half of seismic weight of full height partitions is carried by roof diaphragm above.

	Location	Length (ft)	Height (ft)	Area (sf)	Unit Weight (psf)	Weight (lbs)	Subtotal (lbs)
One Half of Partitions Above Floor	1 thru 6; D thru G N-S	120	6.9	828	6.0	4,968	
One Half of Partitions Above Floor	2 thru 6; D thru G E-W	90	6.9	621	6.0	3,726	
							8,694

Seismic Dead Weight of Partitions Contributing to Roof Diaphragm of Building Section 1 **8,694 lbs**

	Area	Unit Weight	
FEMA 310, Section 3.5.1, actual or minimum partition weight of 10 psf: Note: Assumed 1/2 is transferred to floor and 1/2 to ceiling, thus 5 psf.	4368	5.0	**21,840 lbs**

Say 21,840 lbs

STRUCTURE WEIGHTS

Weight of Building Section 2 (Two Story Portion of Building)
Seismic Weight Attributed to the Second Floor Diaphragm)

Floor	Item	Unit Weight (psf)	Length (ft)	Width (ft)	Weight (lbs)	Part Subtotal (lbs)
	1 1/2" deck w/ 2 1/2" concrete	40.0	174.7	76.7	535,980	
	Acoustical tile below	1.5	174.7	76.7	20,099	
	Lights, HVAC, etc.	5.0	174.7	76.7	66,997	
						623,076

Floor Beams	Location		Unit Weight (plf)	Length (ft)	Number	Weight (lbs)	Part Subtotal (lbs)
	A-line	W14x22	22	24	7	3,696	
	B-line	W16x31	31	24	7	5,208	
	C-line	W18x40	40	24	4	3,840	
	C-line	W16x31	31	24	3	2,232	
	D-line	W14x22	22	24	3	1,584	
	D-line	W18x45	45	24	2	2,160	
	D-line	W18x35	35	24	2	1,680	
	1-line	W14x22	22	24	1	528	
	1-line	M14x17.2	17.2	24	2	826	
	2-line	W14x22	22	24	1	528	
	2-line	M14x17.2	17.2	24	2	826	
	3-line	W14x22	22	24	1	528	
	3-line	M14x17.2	17.2	24	2	826	
	4-line	W14x22	22	24	1	528	
	4-line	M14x17.2	17.2	24	1	413	
	4-line	W14x26	26	24	1	624	
	5-line	W14x22	22	24	2	1,056	
	5-line	M14x17.2	17.2	24	1	413	
	7 & 8-line	M14x17.2	17.2	24	6	2,477	
	9-line	M14x17.2	17.2	24	2	826	
	9-line	W14x22	22	24	1	528	
	Intermediate	M14x17.2	17.2	24	33	13,622	
	Intermediate	W14x22	22	24	8	4,224	
	Ledgers @ 1 & 9	W12x16.5	16.5	24	6	2,376	
	Ledgers @ D	W12x16.5	16.5	24	2	792	
	Ledgers @ D	W14x22	22	24	1	528	
							52,867

Seismic Dead Weight of Floor Contributing to Second Floor Diaphragm of Building Section 2 **675,943 lbs**

Say 680,000 lbs

STRUCTURE WEIGHTS

Weight of Building Section 2 (Two Story Portion of Building) (Continued)

(Continuation of Seismic Weight Attributed to Second Floor Diaphragm)

Use one half of column height above floor and one half of column height below floor.

Columns		Unit Weight (plf)	Height (ft)	Number	Weight (lbs)
1/2 Col. Below Flr. + 1/2 Col. Above Flr.	8" STD pipe	28.55	13.5	25	9,636
1/2 Col. Below Flr. + 1/2 Col. Above Flr.	8" XXS pipe	72.4	13.5	7	6,842
1/2 Brace Length Below Floor	6" STD pipe	18.97	18.3	10	3,472
1/2 Brace Length Above Floor	5" STD pipe	14.62	17.6	10	2,573
					22,522

Unit Weight of Exterior Walls	Unit Weight (psf)
4" Brick	40.0
1/2" Plywood	1.5
6" Steel Studs @ 24"	1.0
6" Batt Insulation	2.4
5/8" Gypsum Brd.	2.5
	47.4

Notes for Wall and Column Weight Calculations

1. Neglect window area. Assume the entire wall is typical construction. This will be conservative. Windows are small and do not cover a large area of the wall. Increased weight determined by this assumption will be used to account for brick pavers (window sills) which are not included in estimate.

2. Column & wall weights are based on assumption that 1/2 of story height below the floor plus 1/2 of story height above the floor contribute to the seismic weight at the floor level.

Walls

	Location	Length (ft)	Height (ft)	Area (sf)	Unit Weight (psf)	Weight (lbs)	Subtotal (lbs)
Area of Exterior Walls	A-line	174.7	13.5	2,358	47.4	111,791	
	D-line	75.0	13.5	1,013	47.4	47,993	
	1-line	76.7	13.5	1,035	47.4	49,080	
	9-line	76.7	13.5	1,035	47.4	49,080	
							257,944

Seismic Dead Weight of Wall Contributing to Second Floor Diaphragm of Building Section 2 **280,466 lbs**

Say 282,000 lbs

STRUCTURE WEIGHTS

Weight of Partitions Contributing to Second Floor Diaphragm of Building Section 2

(Unit Weight of 2X4 metal stud wall with gypsum board each side = 6 psf)

(Assume that all partitions are full height from top of lower slab to bottom of deck above. This is conservative, not all partition walls are full height.)

	Location	Length (ft)	Height (ft)	Area (sf)	Unit Weight (psf)	Weight (lbs)	Subtotal (lbs)
One Half of Partitions Below Floor	1 thru 9; A thru B N-S	185	6.4	1184	6.0	7,104	
One Half of Partitions Below Floor	1 thru 9; A thru B E-W	150	6.4	960	6.0	5,760	
One Half of Partitions Below Floor	1 thru 9; C thru D N-S	220	6.4	1408	6.0	8,448	
One Half of Partitions Below Floor	1 thru 9; C thru D E-W	219	6.4	1402	6.0	8,410	
One Half of Partitions Above Floor	5 thru 9; A thru B N-S	186	6.4	1190	6.0	7,142	
One Half of Partitions Above Floor	5 thru 9; A thru B E-W	178	6.4	1139	6.0	6,835	
One Half of Partitions Above Floor	2 thru 7; C thru D N-S	211	6.4	1350	6.0	8,102	
One Half of Partitions Above Floor	2 thru 7; C thru D E-W	196	6.4	1254	6.0	7,526	
							59,328

Seismic Dead Weight of Partitions Contributing to Second Floor Diaphragm of Building Section 2 **59,328 lbs**

	Area	Unit Weight	
FEMA 310, Section 3.5.1, actual or minimum partition weight of 10 psf:	12095	10.0	**120,950 lbs**

Note: Assumed 1/2 is transferred to floor and 1/2 to ceiling, thus 5 psf.

Say 120,960 lbs

STRUCTURE WEIGHTS

Weight of Building Section 2 (Two Story Portion of Building)

Seismic Weight Attributed to the Roof Diaphragm)

Roof	Unit Weight (psf)	Length (ft)	Width (ft)	Area (ft^2)	Weight (lbs)	Part Subtotal (lbs)
1 1/2" x 18 ga. deck	2.7	174.7	76.7	13399	36,179	
4" Rigid Board Insul.	6.0	174.7	76.7	13399	80,397	
Built up Roof	6.5	174.7	76.7	13399	87,097	
Acoustical Tile below	1.5	174.7	76.7	13399	20,099	
Lights, HVAC, etc.	5.0	174.7	76.7	13399	66,997	
						290,769

Roof Beams		Unit Weight (plf)	Length (ft)	Number	Weight (lbs)	
A-line	W14x22	22	24	1	528	
A-line	W18x35	35	24	1	840	
A-line	W16x31	31	24	5	3,720	
B & C-line	W14x22	22	24	14	7,392	
D-line	W16x31	31	24	5	3,720	
D-line	W18x35	35	24	1	840	
D-line	W14x22	22	24	1	528	
1-line	W14x22	22	24	3	1,584	
2 thru 9-line	W14x22	22	24	12	6,336	
2 thru 9-line	M12x11.8	11.8	24	9	2,549	
Intermediate	M12x11.8	11.8	24	42	11,894	
Ledgers @ 1 & 9	W10x15	15	24	6	2,160	
Ledgers @ A & D	W10x15	15	24	14	5,040	
						47,131

Seismic Dead Weight of Roof Contributing to Roof Diaphragm of Building Section 2 **337,900 lbs**

Say 340,000 lbs

STRUCTURE WEIGHTS

Weight of Building Section 2 (Two Story Portion of Building)
Seismic Weight Attributed to the Roof Diaphragm)

Columns		Unit Weight (plf)	Height (ft)	Number	Weight (lbs)	
1/2 of Column Height Below Roof	8" XXS pipe	72.4	6.9	32	15,986	
1/2 of Brace Length Below Roof	5" STD pipe	14.62	18.3	10	2,675	
						18,661

Weight of Building Section 2 (Two Story Portion of Building) (Continued)

Unit Weight of Exterior Walls	Unit Weight (psf)
4" Brick	40.0
1/2" Plywood	1.5
6" Steel Studs @ 24"	1.0
6" Batt Insulation	2.4
5/8" Gypsum Brd.	2.5
	47.4

Notes for Wall and Column Weight Calculations

1. Neglect window area. Assume the entire wall is typical construction. This will be conservative. Windows are small and do not cover a large area of the wall. Increased weight determined by this assumption will be used to account for brick pavers (window sills) which are not included in estimate.

2. Column & wall weights are based on assumption that 1/2 of story height below the roof contributes to the seismic weight at the roof level. 2' added to height to account for parapet.

Walls

		Length (ft)	Height (ft)	Area (sf)	Unit Weight (psf)	Weight (lbs)	Subtotal (lbs)
Total Area of Exterior Walls	A-line	174.7	8.4	1,467	47.4	69,559	
	D-line	174.7	8.4	1,467	47.4	69,559	
	1-line	76.7	8.4	644	47.4	30,539	
	9-line	76.7	8.4	644	47.4	30,539	
							200,195

Seismic Dead Weight of Walls Contributing to Roof Diaphragm of Building Section 2 **218,856 lbs**

Say 220,000 lbs

STRUCTURE WEIGHTS

Weight of Partitions Contributing to Roof Diaphragm of Building Section 2
(Unit Weight of 2X4 metal stud wall with gypsum board each side = 6 psf)
(Assume that all partitions are full height from top of lower slab to bottom of deck above. This is conservative, not all partition walls are full height.)

	Location	Length (ft)	Height (ft)	Area (sf)	Unit Weight (psf)	Weight (lbs)	Subtotal
One Half of Partitions Below Roof	5 thru 9; A thru B N-S	186	6.4	1190	6.0	7,142	
One Half of Partitions Below Roof	5 thru 9; A thru B E-W	178	6.4	1139	6.0	6,835	
One Half of Partitions Below Roof	2 thru 7; C thru D N-S	211	6.4	1350	6.0	8,102	
One Half of Partitions Below Roof	2 thru 7; C thru D E-W	196	6.4	1254	6.0	7,526	
							29,606

Seismic Dead Weight of Partitions Contributing to Second Floor Diaphragm of Building Section 2 **29,606 lbs**

	Area	Unit Weight	
FEMA 310, Section 3.5.1, actual or minimum partition weight of 10 psf: Note: Assumed 1/2 is transferred to floor and 1/2 to ceiling, thus 5 psf.	12095	5.0	**60,475 lbs**

Say 60,480 lbs

Appendix D -- Screening Phase Calculations (Tier 1)

(Quick Check Calculations MathCad File BOISDOT1.MCD)

Determine Base Shear in Principal Directions:

Reference:

1997 NEHRP Recommended Provisions for Seismic Regulations for New Buildings And Other Structures, FEMA-302, February 1998, Part 1 Provisions (Part 2 Commentary, FEMA 303).

FEMA 310, Handbook for the Seismic Evaluation of Buildings -- A Prestandard, January 1998.

Given:

Lower story height; $h_1 := 13.83$ feet

Second story height: $h_2 := 12.87$ feet

Total building height: $h_{total} := h_1 + h_2$ $h_{total} = 26.7$ feet

Number of stories $N_{story} := 2$

Overall Transverse Length of Building Section 1: $L_{trans1} := 52$ feet

Overall Longitudinal Length of Building Section 1: $L_{long1} := 84$ feet

Overall Transverse Length of Building Section 2: $L_{trans2} := 72$ feet

Overall Longitudinal Length of Building Section 2: $L_{long2} := 168$ feet

Length of a Typical Bay in Longitudinal and Transverse Directions: $L_{bay} := 24$ feet

Seismic Dead Weight Excluding Partition Dead Load
(See Excel File BOISDOWT.XLS)

Total structure seismic weight of **roof** of Building Section 1 excluding partitions to be applied at roof diaphragm: $W_{seisdlrf1} := 130000$ lbs

Total structure seismic weight of exterior **walls** of Building Section 1 to be applied at roof diaphragm: $W_{seisdlwl1} := 85000$ lbs

Total structure seismic weight of **floor** of Building Section 2 excluding partitions to be applied at second floor diaphragm $W_{seisdlfl2} := 680000$ lbs

Total structure seismic weight of exterior **walls** of Building Section 2 to be applied at second floor diaphragm $W_{seisdlwlfl2} := 282000$ lbs

Total structure seismic weight of **roof** of Building Section 2 excluding partitions to be applied at roof diaphragm $W_{seisdlrf2} := 340000$ lbs

Total structure seismic weight of exterior **walls** of Building Section 2 to be applied at roof diaphragm $W_{seisdlwlrf2} := 220000$ lbs

Determine Base Shear in Principal Directions (Continued):

Per FEMA 310, Section 3.5.2.1, "W" is the total dead load and anticipated live load. "W" is comprised of:

1. In storage and warehouse occupancies, a minimum of 25% of the floor live load.
2. The actual partition weight or a minimum weight of 10 psf of floor area whichever is greater.
3. The applicable snow load.
4. The total weight of permanent equipment and furnishings.

Partition Dead Weight:

Minimum partition dead load is 10 psf per FEMA 310, Section 3.5.2.1: Since a majority of partitions are full story height, apply one half of partition load to floor below and one half to ceiling/roof above.

$w_{partitionmin} := 10$ psf

Actual Partition Dead Weights, (See Excel File BOISDOWT.XLS)

Actual Partition Dead Weight For Building Section 1 to be Applied to Roof Diaphragm:

$W_{partitionact1} := 8800$ lbs.

Minimum Partition Dead Weight for Building Section 1 to be Applied to Roof Diaphragm:

$$W_{partitionmin1} := \frac{w_{partitionmin}}{2} \cdot L_{long1} \cdot L_{trans1}$$

$W_{partitionmin1} = 21840$ lbs.

Weight of Partitions to be Used for Tier 1 Evaluation to be Applied to Roof Diaphragm of Building Section 1:

$$W_{partition1} := \mathrm{if}\left(W_{partitionact1} > W_{partitionmin1}, W_{partitionact1}, W_{partitionmin1}\right)$$

$W_{partition1} = 21840$ lbs.

Actual Partition Dead Weight for Building Section 2 to be Applied at Second Floor Diaphragm.

$W_{partitionactsf2} := 61000$ lbs.

Minimum Partition Dead Weight for Building Section 2 to be Applied at Second Floor Diaphragm:

$$W_{partitionminsf2} := w_{partitionmin} \cdot L_{long2} \cdot L_{trans2}$$

$W_{partitionminsf2} = 120960$ lbs.

Weight of Partitions to be Used for Tier 1 Evaluation to be Applied to Second Floor Diaphragm of Building Section 2:

$$W_{partitionsf2} := \mathrm{if}\left(W_{partitionactsf2} > W_{partitionminsf2}, W_{partitionactsf2}, W_{partitionminsf2}\right)$$

$W_{partitionsf2} = 120960$ lbs.

Determine Base Shear in Principal Directions (continued):

Actual Partition Dead Weight for Building Section 2
to be Applied at Roof Diaphragm $W_{partitionactrf2} := 31000$ lbs.

Minimum Partition Dead Weight of Building Section 2
to be Applied at Second Floor Diaphragm

$W_{partitionminrf2} := \frac{w_{partitionmin}}{2} \cdot L_{long2} \cdot L_{trans2}$ $W_{partitionminrf2} = 60480$ lbs.

Weight of Partitions to be Used for Tier 1 Evaluation
to be Applied to the Roof Diaphragm of Building Section 2:

$W_{partitionrf2} := if\left(W_{partitionactrf2} > W_{partitionminrf2}, W_{partitionactrf2}, W_{partitionminrf2}\right)$

$W_{partitionrf2} = 60480$ lbs.

Note: A minimal area of this building has fixed partitions installed; therefore, the minimum partition load controls.

Live Loading:

Second Floor Full Design Unit Live Load:
(Appendix A, Figure No. 14) $w_{2fdll} := 65.0$ psf

Second Floor Effective Live Load:
Per FEMA 310, Section 3.5.2.1, this building is not used as a warehouse or storage; therefore, $LL_{eff} = 0$ psf $w_{2effll} := 0.0$ psf

$W_{2EFFLL} := w_{2effll} \cdot L_{trans1} \cdot L_{long1}$ $W_{2EFFLL} = 0$ lbs.

Effect of Snow Loading (FEMA 310, Section 3.5.2.1 and 4.2.4.2):

Effective snow load: 70% of full design snow load, or where conditions warrant and approved by regulatory agency, not less than 20% of full design snow load, except where design snow is 30 psf or less, $Q_s=0.0$

Snow load for Boise ID is 25 psf per City of Boise Building Department (208) 384-3802. Per Appendix A, Figure No. 14 the original design load for the roof was 30 psf. Since both loads are equal to or less than 30 psf limit, Use $SL_{eff} = 0$ psf. $w_{fdsl} := 30$ psf

$w_{effsl} := if\left(w_{fdsl} \le 30, 0.0, 0.7 \cdot w_{fdsl}\right)$ $w_{effsl} = 0$ psf

Total effective snow load for Building Section 1: $W_{EFFSL1} := w_{effsl} \cdot \left(L_{trans1} \cdot L_{long1}\right)$ $W_{EFFSL1} = 0$ lbs

Total effective snow load for Building Section 2: $W_{EFFSL2} := w_{effsl} \cdot \left(L_{trans2} \cdot L_{long2}\right)$ $W_{EFFSL2} = 0$ lbs

Determine Base Shear in Principal Directions (continued):

Total Seismic Weight of Building Sections:
Combine seismic dead load plus live load or effective snow load plus partition load whichever is greater.

Building Section 1:

$W_{seisrf1} := W_{seisdlrf1} + W_{seisdlwl1} + W_{partition1} + W_{EFFSL1}$ $W_{seisrf1} = 236840$ lbs

Building Section 2 Roof Diaphragm:

$W_{seisrf2} := W_{seisdlrf2} + W_{seisdlwlrf2} + W_{partitionrf2} + W_{EFFSL2}$ $W_{seisrf2} = 620480$ lbs

Building Section 2 Floor Diaphragm:

$W_{seisfl2} := W_{seisdlfl2} + W_{seisdlwlfl2} + W_{partitionsf2} + W_{EFFSL2}$ $W_{seisfl2} = 1082960$ lbs.

Total Seismic Weight of Building Section 1:

$W_{seis1} := W_{seisrf1}$ $W_{seis1} = 236840$ lbs.

Total Seismic Weight of Building Section 2:

$W_{seis2} := W_{seisrf2} + W_{seisfl2}$ $W_{seis2} = 1703440$ lbs.

Total Seismic Weight of Entire Building:

$W_{seistot} := W_{seis1} + W_{seis2}$ $W_{seistot} = 1940280$ lbs.

Note Checker Rodney Barthel September 17, 1999: Generally, in-plane walls of exterior walls and partitions self inertial mass does not get transferred into the horizontal diaphragms. The out-of-plane walls will transfer their inertial mass into the horizontal diaphragm where the force is transferred into vertial lateral-force-resisting systems (braced frames). The simultaneous inclusion of both principal building direction walls into the horizonal diaphragms is a conservative approach when calculating orthogal seismic weights. The approach is acceptable.

Determine Base Shear in Principal Directions (continued):

Level of Performance (LOP) FEMA 310, Section 1.3 and 2.4, (Page 1-6 and 2-3):

Life-Safety (LS) Performance Level --- Building performance that includes significant damage to both structural and nonstructural components during a design earthquake, though at least some margin against either partial or total structural collapse remains. Injuries may occur, but the level of risk for life threatening injury and entrapment is low.

<--- LOP

Immediate Occupancy (IO) Performance Level -- Building performance that includes very limited damage to both structural and nonstructural components during the design earthquake. The basic vertical and lateral-force-resisting systems retain nearly all of their pre-earthquake strength and stiffness. The level of risk for life threatening injury as a result of damage is very low. Although some minor repairs may be necessary, the building is fully habitable after a design earthquake, and the needed repairs may be completed while the building is occupied.

1997 NEHRP, FEMA 302, Section 2.1 Glossary (Page 7 and 10):

Design Earthquake: Earthquake effects that are two-thirds of the corresponding maximum considered earthquake.

FEMA 310, Section 1.3, page 1-6, See Maximum Considered Earthquake.

Maximum Considered Earthquake Ground Motion: The most severe earthquake effects considered by these provisions as defined in Section 4.1.

FEMA 310, Section 1.3, page 1-7, An earthquake with a 2% probability of exceedance in 50 years with deterministic-based maximum values near known fault sources.

Determine Base Shear in Principal Directions (continued):

1997 NEHRP, FEMA 302, Section 4.1 Procedures for Determining Maximum Considered Earthquake And Design Earthquake Ground Motion Accelerations And Response Spectra (Page 33):

Ground motion accelerations, represented by response spectra and coefficients derived from these spectra, shall be determined in accordance with the general procedure of Section 4.1.2 or the site-specific procedure of Section 4.1.3. The general procedure in which spectral response acceleration parameters for the maximum considered earthquake ground motions are derived using Maps 1 through 24, modified by site coefficients to include local site effects and scaled to design values, are permitted to be used for any structure except as specifically indicated in these Provisions.

1997 NEHRP, FEMA 302, Section 4.1.1 Maximum Considered Earthquake Ground Motions (Page 33):

The **maximum considered earthquake ground motions** shall be represented by the mapped spectral response acceleration at short periods (**S_s**) and 1 second period (**S_1**), obtained from Maps 1 through 24 of these Provisions, and adjusted for Site Class effects using the site coefficients of Section 4.1.2.4 (page 37) . See FEMA 310, Section 3.5.2.3.1, Page 3-10.

1997 NEHRP, FEMA 302, Section 4.1.2 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations (Page 33):

For structures located in those regions of the maps having values of the short period spectral acceleration, S_s, less than or equal to 0.15g and values of the 1 second period spectral response acceleration, S1, less than or equal to 0.04g, accelerations need not be determined. Such structures are permitted to be directly categorized as Seismic Design Category (SDC) A in accordance with Section 4.2.1.

For all other structures, the Site Class shall be determined in accordance with Section **4.1.2.1**. The **maximum considered earthquake** spectral response accelerations adjusted for Site Class effects, **S_{MS}** and **S_{M1}**, shall be determined in accordance with Section **4.1.2.4** and the **design spectral response** accelerations at short periods, **S_{DS}**, and at 1 second, **S_{D1}**, shall be determined in accordance with Section **4.1.2.5.** The general response spectrum shall be determined in accordance with **Section 4.1.2.6**.

Maximum Considered Earthquake:

Map 1: Maximum Considered Earthquake Ground Motion for the U.S. for 0.2 Second Spectral Response Acceleration (%g) 5% of critical damping Site Class B.

$$S_s := \frac{35.6}{100}$$

Map 2: Maximum Considered Earthquake Ground Motion for the U.S. for 1 Second Spectral Response Acceleration (%g) 5% of critical damping Site Class B.

$$S_1 := \frac{10.9}{100}$$

State: **Idaho** County: **ADA** Zip Code: **83705**

http://geohazards.cr.usgs.gov/eq/html/zipcode.shtml @ 2% PE in 50 Year for 0.2 and 1.0 sec SA

Determine Base Shear in Principal Directions (continued):

Site Class Determination:

$S_s = 0.356$

1997 NEHRP, FEMA 302, Section 4.1.2.1, Site Class Definitions (Page 33):

$S_1 = 0.109$

For all structures located within those regions of the maps having values of the short-period spectral response acceleration, S_s, greater than 0.15g or values of the 1 second period spectral response acceleration, S1, greater than 0.04g, the site shall be classified as one of the Site Classes defined on page 34. Parameters for determining Site Class are a function of the soil shear wave velocity (V_{bars}), Standard Penetration Resistance (N_{bar}) or from soil unconfined shear strength (s_{baru}). Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions. When the soil properties are not known in sufficient detail to determine the Site Class, Site Class D shall be used. Site Classes E or F need not be assumed unless the authority having jurisdiction determines that Site Classes E or F could be present at the site or in the event that Site Class E or F are established by geotechnical data.

FEMA 310, Section 3.5.2.3.1, Site Class Definitions (Page 3-10):

The soil profile is classified as Class D based on the Geotechnical Investigation report dated June 5, 1986 prepared by Northern Engineering and Testing, Inc. for the BLM warehouse and Maintenance Building adjacent to the building being investigated in this report.

Site Class: D

Determine Base Shear in Principal Directions (continued):

1997 NEHRP, FEMA 302, Section 4.1.2.4 Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters (Page 37):

Interpolation for variable F_v w/Table 3-5

Value of Site Coefficient F_v as a Function of Site Class and Mapped 1 Second Period (S_1) Maximum Considered Earthquake Spectral Acceleration (Table 4.1.2.4b) (FEMA 310, Page 2-4 and Table 3-5, Page 3-10):

$S_{1L} := 0.1 \qquad F_{vL} := 2.4$

$S_1 = 0.109$

$S_{1H} := 0.2 \qquad F_{vH} := 2.0$

$$F_v := \frac{F_{vH} - F_{vL}}{S_{1H} - S_{1L}} \cdot \left(S_1 - S_{1L}\right) + F_{vL} \qquad F_v = 2.364$$

Interpolation for variable F_a w/Table 3-6

Value of Site Coefficient F_a as a Function of Site Class and Mapped Short Periods (S_s) Maximum Considered Earthquake Spectral Acceleration (Table 4.1.2.4a) (FEMA 310, Page 2-4 and Table 3-6, Page 3-10):

$S_{sL} := 0.25 \qquad F_{aL} := 1.6$

$S_s = 0.356$

$S_{sH} := 0.50 \qquad F_{aH} := 1.4$

$$F_a := \frac{F_{aH} - F_{aL}}{S_{sH} - S_{sL}} \cdot \left(S_s - S_{sL}\right) + F_{aL} \qquad F_a = 1.515$$

1997 NEHRP, FEMA 302, Section 4.1.2.4 Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters (Page 37):

Equation 4.1.2.4-1: $S_s = 0.356 \qquad S_{MS} := F_a \cdot S_s \qquad S_{MS} = 0.54$

Equation 4.1.2.4-2: $S_1 = 0.109 \qquad S_{M1} := F_v \cdot S_1 \qquad S_{M1} = 0.258$

Determine Base Shear in Principal Directions (continued):

1997 NEHRP, FEMA 302, Section 4.1.2.5 Design Spectral Response Acceleration Parameters (Page 38):

Design earthquake spectral response acceleration at short periods, S_{DS}, and at 1 second, S_{D1}, shall be determined from formulas 4.1.2.5-1 and 4.1.2.5-2.

1997 NEHRP, FEMA 302, Equation 4.1.2.5-1, Page 38 :
(FEMA 310, Section 3.5.2.3.1, Equation 3-6, page 3-9)

$$S_{DS} := \frac{2}{3} \cdot S_{MS} \qquad S_{DS} = 0.36$$

1997 NEHRP, FEMA 302, Equation 4.1.2.5-2, Page 38 :
(FEMA 310, Section 3.5.2.3.1, Equation 3-5, page 3-9)

$$S_{D1} := \frac{2}{3} \cdot S_{M1} \qquad S_{D1} = 0.17$$

FEMA 310, Section 2.5, Table 2-1, Region of Seismicity (Page 2-4):

The highest region of seismicity defined by S_{DS} or S_{D1} shall govern. S_{DS} -- **Moderate**

S_{D1} -- **Moderate**

Region of Seismicity -------> Moderate

Determine Building Type Rigid or Flexible Diaphragm): Is the floor diaphragm considered a rigid or a flexible diaphragm? ("Design of Low-Rise Concrete Buildings for Earthquake Forces", Second Edition, pg. 4-2 and Chapter 5 of the "Seismic Design for Buildings, Departments of the Army, The Navy, and the Air Force", October 1992, Army TM 5-809-10, NAVY NAVFAC P-355, Air Force AFM 88-3, Chapter 13. -- See Rodney Barthel D8110 for manuals)

Thickness of slab:	$h_{slab} := 4.5$	in.
Unit Weight of Concrete:	$w_c := 150$	lbs./cu. ft.
Concrete Strength: (Appendix A, Figure No. 14)	$f_c := 3000$	psi

Flexibility Factor:

$$F := \frac{10^6}{8.5 \cdot h_{slab} \cdot w_c^{1.5} \cdot \sqrt{f_c}} \qquad F = 0.26$$

if(F< 1.0, "Rigid Diaphragm" , "See Table 4-1") = "Rigid Diaphragm"

Determine Base Shear in Principal Directions (continued):

FEMA 310, Section 3.5.2.4, Period (Page 3-11):

The structure consists of steel braced frames in both the transverse and longitudinal directions; therefore, the structure will be evaluated as a Type S2 (Steel Braced Frames with Rigid Diaphragms) in both directions.

Longitudinal Period Equation Coefficient (**Steel Braced Frame with Rigid Diaphragms, Building Type S2**): $C_{Tlong} := 0.030$

Transverse Period Equation Coefficient (**Steel Braced Frame with Rigid Diaphragms, Building Type S2**): $C_{Ttrans} := 0.030$

Height in feet above the base to the roof level of the building:

$h_n := h_1 + h_2$ $h_n = 26.7$ feet

Longitudinal Orthogonal Direction:

Fundamental period (1997 NEHRP, FEMA 302, Equation 5.3.3.1-1, page 67) or FEMA 310, Section 3.5.2.4, Equation 3-7, page 3-11

$T_{along} := C_{Tlong} \cdot h_n^{\frac{3}{4}}$ $T_{along} = 0.352$ seconds

Transverse Orthogonal Direction:

$T_{atrans} := C_{Ttrans} \cdot h_n^{\frac{3}{4}}$ $T_{atrans} = 0.352$ seconds

Mapped Spectral Acceleration, FEMA 310, Section 3.5.2.3.1, Equation 3-4, Page 3-9:

$S_{D1} = 0.17$ $S_{DS} = 0.36$ $S_{along} := \frac{S_{D1}}{T_{along}}$ $S_{atrans} := \frac{S_{D1}}{T_{atrans}}$

$S_{along} = 0.488$ $S_{along} := \mathrm{if}\left(S_{along} > S_{DS}, S_{DS}, S_{along}\right)$ $S_{along} = 0.36$

$S_{atrans} = 0.488$ $S_{atrans} := \mathrm{if}\left(S_{atrans} > S_{DS}, S_{DS}, S_{atrans}\right)$ $S_{atrans} = 0.36$

Determine Base Shear in Principal Directions (continued):

FEMA 310, Section 3.5.2.1 Calculation of Modification Factor (Page 3-8):

The modification factor to relate expected maximum inelastic displacements to displacements calculated for linear elastic response; C shall be taken from FEMA 310, Table 3-4.
The "C" value for Building Type S2 (Steel Braced Frame with Rigid Diaphragm) is 1.2 and the "C" value for Building Type S2A (Steel Braced Frame with Flexible Diaphragms) is 1.0. This building consists of a flexible diaphragm at the roof level and a rigid diaphragm at the second floor level. Use C=1.2 for analysis. This will create the highest pseudo lateral force.

Number of stories $N_{story} = 2$

Modification factor for **transverse** direction Building Type **S2** $C_{trans} := 1.2$

Modification factor for **longitudinal** direction Building Type **S2** $C_{long} := 1.2$

Pseudo Lateral Force Factor:

Transverse Direction: $C_{trans} \cdot S_{atrans} = 0.432$

Longitudinal Direction: $C_{long} \cdot S_{along} = 0.432$

FEMA 310, Section 3.5.2.1 Pseudo Lateral Force (Equation 3-1, Page 3-8):

Method 1 for Building Section 1:

Transverse Direction: $V_{1trans} := C_{trans} \cdot S_{atrans} \cdot W_{seis1}$ $V_{1trans} = 102203$ lbs

Longitudinal Direction: $V_{1long} := C_{long} \cdot S_{atrans} \cdot W_{seis1}$ $V_{1long} = 102203$ lbs

Method 1 for Building Section 2:

Transverse Direction: $V_{2trans} := C_{trans} \cdot S_{atrans} \cdot W_{seis2}$ $V_{2trans} = 735084$ lbs

Longitudinal Direction: $V_{2long} := C_{long} \cdot S_{atrans} \cdot W_{seis2}$ $V_{2long} = 735084$ lbs

Checker Note of Rodney Barthel September 17, 1999: The single story Building Section 1 would have a slightly different fundamental period than the two story Building Section 2, but S_a would default to the controlling S_{DS} for the force factor calculation. However, C = 1.4 for a single story and would change results to force factor of 1.4 * 0.36 = 0.50 versus 0.43.

$V_{check} := 1.4 \cdot \left(S_{atrans} \cdot W_{seis1}\right)$ $V_{check} = 119237$ $V_{check} - V_{1trans} = 17034$ pounds

Determine Base Shear in Principal Directions (continued):

NOTE: Alternatively, for buildings with shallow foundations and without basements being evaluated for Life-Safety Performance Level, FEMA 310, Equation 3-2, may be used to compute the pseudo lateral force. An *m*-factor of 1.0 shall be used to compute the component forces and stresses for the Quick Check of Sections 3.5.3 and acceptance criteria of Section 4.2.4.

FEMA 310, Section 3.5.2.1 Pseudo Lateral Force (Equation 3-1, Page 3-8):

Method 2:

$$V_{2trans} = 0.75 \text{ X } W_{seis}$$

Determine ratio of base shear factors for Method 1 vs. Method 2:

$$ratio := \frac{C_{trans} \cdot S_{atrans}}{0.75} \qquad ratio = 0.575$$

Note: Selecting the smaller of the two base shear factors calculated above may not be an accurate way of determining the controlling base shear force. Method 1 uses m-factors that can be significantly greater than 1.0, and Method 2 uses a m-factors equal to 1.0. An analysis would be required comparing results of both methods for the component being evaluated. Engineering judgment can be used based on inspection of base shear factors and m-factors being used for the component being evaluated (e.g., See FEMA 310, page A-71, for Appendix A Examples, Example 6).

The typical m-factor used in Method 1 for braced frames would be a minimum of 3.0. The m-factor used for Method 2 is 1.0. Since the ratio of base shear factors is less than the m-factor used for Method 1, the pseudo lateral force determined by Method 1 controls.

Pseudo Lateral Force for Building Section 1

$V_{1trans} = 102203$ lbs. $V_{1long} = 102203$ lbs.

Pseudo Lateral Force for Building Section 2

$V_{2trans} = 735084$ lbs. $V_{2long} = 735084$ lbs.

Determine Base Shear in Principal Directions (continued):

FEMA 310, Section 3.5.2.2 Story Shear Forces, Vj (Equation 3-3, Page 3-9):

Note: For multistory buildings, the pseudo lateral force computed in accordance with Section 3.5.2.1 shall be distributed vertically in accordance with Equation 3-3.

Vertically distribute the pseudo lateral force for Building Section 2 into a story shear at the second floor diaphragm and a story shear at the roof diaphragm.

Determine pseudo lateral force at second floor diaphragm of Building Section 2:

Total number of stories above ground level: $n := N_{story}$ $n = 2$

Number of story level under consideration: $j := 1$

Total of seismic dead load of all stories above level j:

$W_{2j1trans} := W_{seisrf2} + W_{seisfl2}$ $W_{2j1trans} = 1703440$ lbs

$W_{2j1long} := W_{seisrf2} + W_{seisfl2}$ $W_{2j1long} = 1703440$ lbs

$W_{seis2} = 1703440$ lbs

$\left(\frac{n+j}{n+1}\right) = 1$ $\left(\frac{W_{2j1trans}}{W_{seis2}}\right) = 1$ $V_{2trans} = 735084$ lbs

Building Section 2, Transverse Direction, Floor Diaphragm:

$$V_{2j1trans} := \left(\frac{n+j}{n+1}\right) \cdot \left(\frac{W_{2j1trans}}{W_{seis2}}\right) \cdot V_{2trans}$$

$V_{2j1trans} = 735084$ lbs **<--- Apply @ Floor Diaphragm of Building Section 2**

$\left(\frac{n+j}{n+1}\right) = 1$ $\left(\frac{W_{2j1long}}{W_{seis2}}\right) = 1$ $V_{2long} = 735084$ lbs

Building Section 2, Longitudinal Direction, Floor Diaphragm:

$$V_{2j1long} := \left(\frac{n+j}{n+1}\right) \cdot \left(\frac{W_{2j1long}}{W_{seis2}}\right) \cdot V_{2long}$$

$V_{2j1long} = 735084$ lbs **<--- Apply @ Floor Diaphragm of Building Section 2**

Determine Base Shear in Principal Directions (continued):

Determine pseudo lateral force at roof diaphragm of Building Section 2:

Number of story level under consideration: $j := 2$

Total of seismic dead load of all stories above level j:

$W_{2j2trans} := W_{seisrf2}$ $\quad W_{2j2trans} = 620480$ lbs

$W_{2j2long} := W_{seisrf2}$ $\quad W_{2j2long} = 620480$ lbs

$\left(\frac{n+j}{n+1}\right) = 1.333$ $\quad \left(\frac{W_{2j2trans}}{W_{seis2}}\right) = 0.364$ $\quad V_{2trans} = 735084$ lbs

Building Section 2, Transverse Direction Roof Diaphragm:

$$V_{2j2trans} := \left(\frac{n+j}{n+1}\right)\cdot\left(\frac{W_{2j2trans}}{W_{seis2}}\right)\cdot V_{2trans}$$

$V_{2j2trans} = 357007$ lbs **<--- Apply @ Roof Diaphragm of Building Section 2**

$\left(\frac{n+j}{n+1}\right) = 1.333$ $\quad \left(\frac{W_{2j2long}}{W_{seis2}}\right) = 0.364$ $\quad V_{2long} = 735084$ lbs

Building Section 2, Longitudinal Direction, Roof Diaphragm:

$$V_{2j2long} := \left(\frac{n+j}{n+1}\right)\cdot\left(\frac{W_{2j2long}}{W_{seis2}}\right)\cdot V_{2long}$$

$V_{2j2long} = 357007$ lbs **<--- Apply @ Roof Diaphragm of Building Section 2**

BASIC STRUCTURAL CHECKLIST ITEMS FOR CBT S2

Steel Braced Frames with Stiff Diaphragms

Weak Story:

The strength of the lateral-force-resisting system in any story shall not be less than 80% of the strength in an adjacent story above or below for Life-Safety and Immediate Occupancy (FEMA 310, Section 4.3.2.1).

The number of braces in both levels of the two story section of the building is identical. The angle between the brace and the horizontal is the same for both levels of bracing. Only the size of the bracing varies. Bracing is 5-inch STD pipe (5" X 0.258") in the upper level and 6-inch STD pipe (6" X .0.280") for bracing in the lower level. The relative strengths of these two braces is proportional to the cross sectional area of the two sections.

Cross Sectional Area of 5-inch STD Pipe: $A_{5STD} := 4.30$ sq. in.

Cross Sectional Area of 6-inch STD Pipe: $A_{6STD} := 5.58$ sq. in.

Ratio of Cross Section Areas: $\text{Ratio}_{strength} := \dfrac{A_{5STD}}{A_{6STD}}$ $\text{Ratio}_{strength} = 0.77$

$$\text{if}\left(\text{Ratio}_{strength} \le 0.80, \text{"Noncompliant"}, \text{"Compliant"}\right) = \text{"Noncompliant"}$$

Structure is **NONCOMPLIANT** for quick check weak story requirements.

Soft Story:

The stiffness of the lateral-force-resisting system in any story shall not be less than 70% of the stiffness in an adjacent story above or below or less than 80% of the average stiffness of the three stories above or below for Life Safety and Immediate Occupancy (FEMA 310, Section 4.3.2.2).

The number of braces in both levels of the two story section of the building is identical. The angle between the brace and the horizontal is the same for both levels of bracing. Only the size of the bracing varies. Bracing is 5-inch STD pipe (5" X 0.258") in the upper level and 6-inch STD pipe (6" X .0.280) for bracing in the lower level. The relative stiffnesses of these two braces is proportional to PL/AE. The only variable between the two brace sections is the cross sectional area of the two sections; therefore, the stiffness is proportional to the area of the braces.

Ratio of Cross Section Areas: $\text{Ratio}_{stiff} := \dfrac{A_{5STD}}{A_{6STD}}$ $\text{Ratio}_{stiff} = 0.77$

$$\text{if}\left(\text{Ratio}_{stiff} \le 0.70, \text{"Noncompliant"}, \text{"Compliant"}\right) = \text{"Compliant"}$$

Structure is **COMPLIANT** for quick check soft story requirements.

Mass:

There shall be no change in effective mass more than 50% from one story to the next for Life Safety and Immediate Occupancy (FEMA 310, Section 4.3.2.5).

Weight of Roof Diaphragm for Building Section 2: $W_{seisdlrf2} = 340000$

Weight of Floor Diaphragm for Building Section 2: $W_{seisdlfl2} = 680000$

$$Ratio_{mass} := \frac{W_{seisdlrf2}}{W_{seisdlfl2}} \qquad Ratio_{mass} = 0.5$$

$$\text{if}\left(Ratio_{mass} > 0.50, \text{"Noncompliant"}, \text{"Compliant"}\right) = \text{"Compliant"}$$

Structure is **COMPLIANT** for quick check mass requirements.

Note Checker Rodney Barthel September 14, 1999: FEMA 310, Section 4.3.2.5, page 4-28, indicates that the effective mass consists of the dead load of the structure, plus the actual weights of the partitions (not 10 psf calculation) and perminent equipment at each floor. This should also include wall weights. Additionally, the comparison need not be made in two stroy structures with light roof loads. It should be made for floor story level comparisons. FEMA 178, Section 3.3.4, page 38, states that a roof that is lighter than the floor below need not be considered. This implies that the check is not made on a two story structure unless the roof is heavy.

Torsion:

The distance between the center of mass and the story center of rigidity shall be less than 20% of the building width in either plan dimension for Life Safety and Immediate Occupancy (FEMA 310, Section 4.3.2.6).

Building Section 1 - Transverse Direction - The center of mass and the center of rigidity in the transverse direction are identical.

Building Section 1 - Longitudinal Direction:
Use G-line as reference

Transverse length of Building Section 1: $L_{trans1} = 52$ ft.

Distance from G-line to center of mass: $CM_1 := \frac{L_{trans1}}{2}$ $CM_1 = 26$ ft.

Distance from G-line to center of rigidity: $CR_1 := \frac{1 \cdot 0 + 1 \cdot 48}{2}$ $CR_1 = 24$ ft.

$$\text{if}\left(CM_1 - CR_1 < 0.20 \cdot L_{trans1}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$$

$$Tors_{long1} := \frac{CM_1 - CR_1}{L_{trans1}} \qquad Tors_{long1} = 0.038$$

Building Section 2 - Transverse Direction:
Use 1-line as reference

Longitudinal length of Building Section 2: $L_{long2} = 168$ ft.

Distance from 1-line to center of mass: $CM_2 := \frac{L_{long2}}{2}$ $CM_2 = 84$ ft.

Distance from 1-line to center of rigidity: $CR_2 := \frac{1 \cdot 0 + 1 \cdot 96 + 1 \cdot 168}{3}$ $CR_2 = 88$ ft.

$$\text{if}\left(CM_2 - CR_2 < 0.20 \cdot L_{long2}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$$

$$Tors_{trans2} := \frac{CM_2 - CR_2}{L_{long2}} \qquad Tors_{trans2} = -0.024$$

Building Section 2 - Longitudinal Direction - The center of mass and the center of rigidity in the longitudinal direction are identical.

Structure is **COMPLIANT** for quick check torsion requirements.

Axial Stress Check in Column Due to Gravity Loads:

The axial stress due to gravity loads in columns subjected to overturning forces shall be less than 0.10Fy for LS and IO. Alternatively, the axial stress due to overturning forces alone, calculated using the Quick Check Procedure of Section 3.5.3.6, shall be less than 0.30 F_y for Life Safety and Immediate Occupancy (FEMA 310, Section 4.4.1.3.2).

Alternate 1: Gravity Loading

Only the columns in the braced frames are subject to overturning loads and therefore these columns need to be checked for gravity loads. These are typically columns along the exterior walls. The only interior column is column 5-B.

Gravity Loading for an Interior Column (Building Lines 5-B)

Tributary Area for Interior Column 5-B: $A_{trib5B} := 24 \cdot 24$ $A_{trib5B} = 576$ sq. ft.

Uniform Roof Dead Load: $w_{rfdl2} := \frac{W_{seisdlrf2}}{L_{trans2} \cdot L_{long2}}$ $w_{rfdl2} = 28.1$ psf

Uniform Second Floor Dead Load: $w_{fldl} := \frac{W_{seisdlfl2}}{L_{trans2} \cdot L_{long2}}$ $w_{fldl} = 56.2$ psf

Roof Live Load: (See Appendix A, Figure No. 14)
Use design roof load of 30 psf is lieu of
snow load requirement of 25 psf
$w_{fdsl} = 30$ psf

Typical Second Floor Live Load:
(See Appendix A, Figure No. 14)
$w_{2fdll} = 65$ psf

Gravity Load on a Typical Interior Column:

$P_{grav5B} := A_{trib5B} \cdot \left(w_{rfdl2} + w_{fdsl} + w_{fldl} + w_{2fdll}\right)$ $P_{grav5B} = 103291$ lbs

Axial Stress Check in Column Due to Gravity Loads (Continued):

Cross Sectional Area of Interior Column 5-B.
This column is 8-inch XXS pipe (8" X 0.875"): $A_{8XXS} := 21.3$ sq. in.

Stress: $f_{agrav5B} := \frac{P_{grav5B}}{A_{8XXS}}$ $f_{agrav5B} = 4849$ psi

Yield strength of steel for columns F_y=36 ksi,
(See Appendix A, Figure No. 14): $F_{ycol} := 36000$ psi

Allowable axial stress for gravity loads for LS or IO: $F_{agrav} := 0.1 \cdot F_{ycol}$ $F_{agrav} = 3600$ psi

$\text{Results} := \text{if}\left(f_{agrav5B} < F_{agrav}, \text{"Compliant"}, \text{"Noncompliant"}\right)$

Results = "Noncompliant"

Structure is **NONCOMPLIANT** for axial stress quick check due to gravity loads. Check Alternate 2.

Demand-to-Capacity Ratio: $DCR := \frac{f_{agrav5B}}{F_{agrav}}$ $DCR = 1.347$

Gravity Loading for a Exterior Column in Building Section 2 (Example; Building Lines 2-A)

Tributary Area for Exterior Column 2-A: $A_{trib2A} := 24 \cdot 12$ $A_{trib2A} = 288$ sq. ft.

Uniform Roof Dead Load: $w_{rfdl2} := \frac{W_{seisdlrf2}}{L_{trans2} \cdot L_{long2}}$ $w_{rfdl2} = 28.1$ psf

Uniform Second Floor Dead Load: $w_{fldl} := \frac{W_{seisdlfl2}}{L_{trans2} \cdot L_{long2}}$ $w_{fldl} = 56.2$ psf

Roof Live Load: (See Appendix A, Figure No. 14)
Use design roof load of 30 psf is lieu of
snow load requirement of 25 psf $w_{fdsl} = 30$ psf

Typical Second Floor Live Load:
(See Appendix A, Figure No. 14) $w_{2fdll} = 65$ psf

Axial Stress Check in Column Due to Gravity Loads (Continued):

Gravity Load on an Exterior Column:

$P_{grav2A} := A_{trib2A} \cdot \left(w_{rfdl2} + w_{fdsl} + w_{fldl} + w_{2fdll}\right)$ $P_{grav2A} = 51646$ lbs

Cross Sectional Area of Exterior Column 2-A.
This column is 8-inch STD pipe (8" X 0.322"):

$A_{8STD} := 8.40$ sq. in.

Stress: $f_{agrav2A} := \dfrac{P_{grav2A}}{A_{8STD}}$ $f_{agrav2A} = 6148$ psi

Allowable axial stress for gravity loads for LS or IO: $F_{agrav} := 0.1 \cdot F_{ycol}$ $F_{agrav} = 3600$ psi

$\text{Results} := \text{if}\left(f_{agrav2A} < F_{agrav}, \text{"Compliant"}, \text{"Noncompliant"}\right)$

$\text{Results} = \text{"Noncompliant"}$

Structure is **NONCOMPLIANT** for axial stress quick check due to gravity loads. Check Alternative 2.

Demand-to-Capacity Ratio: $DCR := \dfrac{f_{agrav2A}}{F_{agrav}}$ $DCR = 1.708$

Axial Stress in Column Due to Gravity Loads - (Continued):

Gravity Loading for a Typical Exterior Column in Building Section 1 (Building Lines 2-F):

Tributary Area for Column 2-F: $A_{trib2F} := 12 \cdot 24$ $A_{trib2F} = 288$ sq. ft.

Uniform Roof Dead Load: $w_{rfdl1} := \dfrac{W_{seisdlrfl}}{L_{trans1} \cdot L_{long1}}$ $w_{rfdl1} = 29.8$ psf

Roof Live Load:
(See Appendix A, Figure No. 14)
Use design roof load of 30 psf is lieu of snow load requirement of 25 psf
$w_{fdsl} = 30$ psf

Typical Columns in Building Section 1 is 5-inch STD pipe (5" X 0.258"): $A_{5STD} = 4.30$ sq. in.

Gravity Load on a Typical Column:

$P_{grav2F} := A_{trib2F} \cdot \left(w_{rfdl1} + w_{fdsl}\right)$ $P_{grav2F} = 17211$ lbs.

Stress: $f_{agrav2F} := \dfrac{P_{grav2F}}{A_{5STD}}$ $f_{agrav2F} = 4003$ psi

Yield strength of steel for columns: $F_{ycol} = 36000$ psi

Allowable axial stress for gravity loads for LS or IO $F_{agrav} := 0.1 \cdot F_{ycol}$ $F_{agrav} = 3600$ psi

$Results := if\left(f_{agrav2F} < F_{agrav}, \text{"Compliant"}, \text{"Noncompliant"}\right)$

$Results = \text{"Noncompliant"}$

Structure is **NONCOMPLIANT** for axial stress quick check due to gravity loads. Check Alternative 2.

Demand-to-Capacity Ratio: $DCR := \dfrac{f_{agrav2F}}{F_{agrav}}$ $DCR = 1.112$

Axial Stress in Column Due to Overturning (FEMA 310, Section 3.5.3.6):

Alternative 2: Overturning Loads

Building Section 2 - Transverse Direction - Lower Columns:

Total number of frames in the transverse direction resisting the overturning force: $n_{2ftrans} := 3$

Pseudo lateral force: $V_{2trans} = 735084$ lbs.

Height above base to roof level: $h_n = 26.7$ ft.

Length of braced frame. Equals the bay length, since only the braced frames resist overturning: $L_{bay} = 24$ ft.

Component modification factor:

Use 2.0 for buildings being evaluated to LS performance level. <---- $m_f := 2.0$

Use 1.3 for buildings being evaluated to IO performance level.

Area of 8-inch XXS pipe (8" X 0.875"): $A_{8XXS} = 21.30$ sq. in.

Overturning force (FEMA 310, Equation 3-14):

$$p_{2ottrans} := \frac{1}{m_f} \cdot \frac{2}{3} \cdot \frac{V_{2trans} \cdot h_n}{L_{bay} \cdot n_{2ftrans}} \qquad p_{2ottrans} = 90865 \text{ lbs.}$$

Axial stress in column due to overturning:

$$f_{2aottrans} := \frac{p_{2ottrans}}{A_{8XXS}} \qquad f_{2aottrans} = 4266 \text{ psi}$$

Allowable axial stress for LS or IO: $F_{aot} := 0.3 \cdot F_{ycol}$ $F_{aot} = 10800$ psi

$$\text{Results} := \text{if}\left(f_{2aottrans} \le F_{aot}, \text{"Compliant"}, \text{"Noncompliant"}\right)$$

$$\text{Results} = \text{"Compliant"}$$

Structure is **COMPLIANT** for axial stress quick check due to overturning in the transverse direction for Building Section 2.

Demand-to-Capacity Ratio: $DCR := \frac{f_{2aottrans}}{F_{aot}}$ $DCR = 0.395$

Axial Stress in Column Due to Overturning (Continued):

Alternative 2: Overturning Loads

Building Section 2 - Longitudinal Direction - Lower Columns:

Number of frames in the longitudinal direction resisting the overturning force: $n_{2flong} := 2$

Psuedo lateral force: $V_{2long} = 735084$ lbs.

Height above base to roof level: $h_n = 26.7$ ft.

Length of braced frame. Equals the bay length, since only the braced frames resist overturning: $L_{bay} = 24$ ft.

Component modification factor:

Use 2.0 for buildings being evaluated to LS performance level. **<----** $m_f := 2.0$

Use 1.3 for buildings being evaluated to IO performance level.

Area of 8-inch STD pipe (8" X 0.322"): $A_{8STD} = 8.40$ sq. in.

Overturning force (FEMA 310, Equation 3-14):

$$p_{2otlong} := \frac{1}{m_f}\cdot\frac{2}{3}\cdot\frac{V_{2long}\cdot h_n}{L_{bay}\cdot n_{2flong}} \qquad p_{2otlong} = 136297 \text{ lbs.}$$

Axial stress in column due to overturning:

$$f_{2aotlong} := \frac{p_{2otlong}}{A_{8STD}} \qquad f_{2aotlong} = 16226 \text{ psi}$$

Allowable axial stress for LS or IO: $F_{aot} := 0.3\cdot F_{ycol}$ $F_{aot} = 10800$ psi

$$\text{Results} := \text{if}\left(f_{2aotlong} \le F_{aot}, \text{"Compliant"}, \text{"Noncompliant"}\right)$$

$$\text{Results} = \text{"Noncompliant"}$$

Structure is **NONCOMPLIANT** for axial stress quick check due to overturning in the longitudinal direction for Building Section 2.

Demand-to-Capacity Ratio: $DCR := \frac{f_{2aotlong}}{F_{aot}}$ $DCR = 1.502$

Axial Stress in Column Due to Overturning (Continued):

Building Section 1 - Transverse Direction:

Total number of frames in the transverse direction resisting the overturning force: $n_{1ftrans} := 2$

Psuedo lateral force: $V_{1trans} = 102203$ lbs.

Height above base to roof level: $h_1 = 13.83$ ft.

Length of braced frame. Equals the bay length, since only the braced frames resist overturning: $L_{bay} = 24$ ft.

Component modification factor:

Use 2.0 for buildings being evaluated to LS performance level. <---- $m_f := 2.0$

Use 1.3 for buildings being evaluated to IO performance level.

Area of 5-inch STD pipe (5" X 0.258") $A_{5STD} = 4.30$ sq. in.

Overturning force (FEMA 310, Equation 3-14):

$$p_{1ottrans} := \frac{1}{m_f} \cdot \frac{2}{3} \cdot \frac{V_{1trans} \cdot h_1}{L_{bay} \cdot n_{1ftrans}} \qquad p_{1ottrans} = 9816 \text{ lbs.}$$

Axial stress in column due to overturning:

$$f_{1aottrans} := \frac{p_{1ottrans}}{A_{5STD}} \qquad f_{1aottrans} = 2283 \text{ psi}$$

Allowable axial stress for LS or IO: $F_{aot} := 0.3 \cdot F_{ycol}$ $\qquad F_{aot} = 10800$ psi

Results := if($f_{1aottrans} \le F_{aot}$, "Compliant" , "Noncompliant")

Results = "Compliant"

Structure is **COMPLIANT** for axial stress quick check due to overturning in the transverse direction for Building Section 1.

Demand-to-Capacity Ratio: $DCR := \frac{f_{1aottrans}}{F_{aot}}$ $\qquad DCR = 0.211$

Axial Stress in Column Due to Overturning (Continued):

Building Section 1 - Longitudinal Direction:

Number of frames in the longitudinal direction resisting the overturning force: $n_{1flong} := 2$

Psuedo lateral force: $V_{1long} = 102203$ lbs.

Height above base to roof level: $h_1 = 13.83$ ft.

Length of braced frame. Equals the bay length, since only the braced frames resist overturning: $L_{bay} = 24$ ft.

Component modification factor:

Use 2.0 for buildings being evaluated to LS performance level. **<----** $m_f := 2.0$

Use 1.3 for buildings being evaluated to IO performance level.

Area of 5-inch STD pipe (5" X 0.258") $A_{5STD} = 4.30$ sq. in.

Overturning force (FEMA 310, Equation 3-14):

$$P_{1otlong} := \frac{1}{m_f} \cdot \frac{2}{3} \cdot \frac{V_{1long} \cdot h_1}{L_{bay} \cdot n_{1flong}} \qquad P_{1otlong} = 9816 \text{ lbs.}$$

Axial stress in column due to overturning:

$$f_{1aotlong} := \frac{P_{1otlong}}{A_{5STD}} \qquad f_{1aotlong} = 2283 \text{ psi}$$

Allowable axial stress for LS or IO: $F_{aot} := 0.3 \cdot F_{ycol}$ $F_{aot} = 10800$ psi

$$\text{Results} := \text{if}\left(f_{1aotlong} \le F_{aot}, \text{"Compliant"}, \text{"Noncompliant"}\right)$$

$$\text{Results} = \text{"Compliant"}$$

Structure is **COMPLIANT** for axial stress quick check due to overturning in the longitudinal direction for Building Section 1.

Demand-to-Capacity Ratio: $DCR := \dfrac{f_{1aotlong}}{F_{aot}}$ $DCR = 0.211$

Axial Stress Check in Diagonals:

The axial stress in the diagonals, calculated using the Quick Check procedure of Section 3.5.3.4, shall be less than 18 ksi or $0.50F_y$ for Life Safety and for Immediate Occupancy (FEMA 310, Section 4.4.3.1.2).

Building Section 2 - Longitudinal Direction - First Story Braces:

Average Span Length of Braced Spans:
Equals 1/2 of typical bay length
$s_{br} := \dfrac{L_{bay}}{2}$ $\quad s_{br} = 12$ ft.

Height of Brace:
Equals the Story Height
$h_{br} := h_1$ $\quad h_{br} = 13.83$ ft.

Length of Brace: $L_{br} := \sqrt{s_{br}^2 + h_{br}^2}$ $\quad L_{br} = 18.31$ ft.

Number of Braces in Longitudinal Direction
Braces are in tension or compression; therefore, use the total number of braces.
$N_{2brlong} := 4$

Area of 6-inch STD Pipe (6" X 0.280"): $A_{6STD} = 5.58$ sq. in.

Yield strength of steel for braces F_y=36 ksi,
(See Appendix A, Figure No. 14):
$F_{ybrace} := 36000$ psi

Determine Component Modification Factor for Diagonal Braces
(FEMA 310, Section 3.5.3.4, Page 3-13, Table 3-8):

Expected strength of braces is equal to 1.25 X F_{ybrace}
(FEMA 310, Section 4.2.4.4, page 4-8)
$F_{yebrace} := 1.25 \cdot F_{ybrace}$

$F_{yebrace} = 45000$ psi.

For 6" STD Pipe (6" X 0.280") and LS performance level

Outside diameter of pipe: $d_{6STD} := 6.625$ in.

Thickness of pipe: $t_{6STD} := 0.280$ in.

Diameter to thickness ratio: $\dfrac{d_{6STD}}{t_{6STD}} = 23.7$

$$m_{6STD} := \text{if}\left[\frac{d_{6STD}}{t_{6STD}} \le \frac{1500}{\left(\dfrac{F_{yebrace}}{1000}\right)}, 6.0, \text{if}\left[\frac{d_{6STD}}{t_{6STD}} > \frac{6000}{\left(\dfrac{F_{yebrace}}{1000}\right)}, 3.0, \text{"Interpolate"}\right]\right] \qquad m_{6STD} = 6.0$$

Axial Stress Check in Diagonals (Continued):

Building Section 2 - Longitudinal Direction - First Story Braces (continued):

Axial Stress in 6-inch STD Pipe Brace: $f_{2brlong} := \frac{1}{m_{6STD}} \cdot \frac{V_{2j1long}}{s_{br} \cdot N_{2brlong}} \cdot \frac{L_{br}}{A_{6STD}}$ $f_{2brlong} = 8375$ psi

Allowable Axial Stress in Diagonals:

$F_{br} := \mathrm{if}\left(18000 > 0.5 \cdot F_{ybrace}, 0.5 \cdot F_{ybrace}, 18000\right)$ $F_{br} = 18000$ psi

$\mathrm{if}\left(f_{2brlong} \le F_{br}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$

Structure is **COMPLIANT** for quick check of axial stress in longitudinal braces at lower level of Building Section 2.

Demand-to-Capacity Ratio: $DCR := \frac{f_{2brlong}}{F_{br}}$ $DCR = 0.465$

Building Section 2 - Transverse Direction - First Story Braces:

The sizes of the braces in the transverse direction are the same as the size of the braces in the longitudinal direction.

Number of Braces in Transverse Direction
Braces are in tension or compression; therefore, use the total number of braces. $N_{2brtrans} := 6$

Axial Stress in 6-inch STD Pipe Brace: $f_{2brtrans} := \frac{1}{m_{6STD}} \cdot \frac{V_{2j1trans}}{s_{br} \cdot N_{2brtrans}} \cdot \frac{L_{br}}{A_{6STD}}$ $f_{2brtrans} = 5584$ psi

$\mathrm{if}\left(f_{2brtrans} \le F_{br}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$

Structure is **COMPLIANT** for quick check of axial stress in transverse braces at lower level of Building Section 2.

Demand-to-Capacity Ratio: $DCR := \frac{f_{2brtrans}}{F_{br}}$ $DCR = 0.31$

Axial Stress Check in Diagonals (Continued):

Building Section 2 - Longitudinal Direction - Second Story Braces:

Average Span Length of Braced Spans:
Equals 1/2 of typical bay length
$s_{br} := \frac{L_{bay}}{2}$ $s_{br} = 12$ ft.

Height of Brace:
Equals the Story Height
$h_{br} := h_2$ $h_{br} = 12.87$ ft.

Length of Brace: $L_{br} := \sqrt{s_{br}^2 + h_{br}^2}$ $L_{br} = 17.597$ ft.

Number of Braces in Longitudinal Direction
Braces are in tension or compression; therefore, use
the total number of braces. Longitudinal direction controls.
$N_{2brlong} := 4$

Area of 5-inch STD Pipe Pipe (5" X 0.258"): $A_{5STD} = 4.30$ sq. in.

Yield strength of steel for braces F_y=36 ksi,
(See Appendix A, Figure No. 14):
$F_{ybrace} := 36000$ psi

Determine Component Modification Factor for Diagonal Braces
(FEMA 310, Section 3.5.3.4, Page 3-13, Table 3-8):

Expected strength of braces is equal to 1.25 X Fybrace
(FEMA 310, Section 4.2.4.4, page 4-8)
$F_{yebrace} := 1.25 \cdot F_{ybrace}$

$F_{yebrace} = 45000$ psi.

For 6" STD Pipe (6" X 0.280") and LS performance level

Outside diameter of pipe: $d_{5STD} := 5.563$ in.

Thickness of pipe: $t_{5STD} := 0.258$ in.

Diameter to thickness ratio: $\frac{d_{5STD}}{t_{5STD}} = 21.6$

$$m_{5STD} := \mathrm{if}\left[\frac{d_{5STD}}{t_{5STD}} \le \frac{1500}{\left(\frac{F_{yebrace}}{1000}\right)}, 6.0, \mathrm{if}\left[\frac{d_{5STD}}{t_{5STD}} > \frac{6000}{\left(\frac{F_{yebrace}}{1000}\right)}, 3.0, \text{"Interpolate"}\right]\right] \qquad m_{5STD} = 6$$

Axial Stress Check in Diagonals (Continued):

Building Section 2 - Longitudinal Direction - Second Story Braces (continued):

Axial Stress in 5-inch STD Pipe Brace:

$$f_{2brlong} := \frac{1}{m_{5STD}} \cdot \frac{V_{2j2long}}{s_{br} \cdot N_{2brlong}} \cdot \frac{L_{br}}{A_{5STD}} \qquad f_{2brlong} = 5073 \text{ psi}$$

Allowable Axial Stress in Diagonals:

$$F_{br} := \text{if}\left(18000 > 0.5 \cdot F_{ybrace}, 0.5 \cdot F_{ybrace}, 18000\right) \qquad F_{br} = 18000 \text{ psi}$$

$$\text{if}\left(f_{2brlong} \le F_{br}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$$

Structure is **COMPLIANT** for quick check of axial stress in longitudinal braces at upper level of Building Section 2.

Demand-to-Capacity Ratio:

$$DCR := \frac{f_{2brlong}}{F_{br}} \qquad DCR = 0.282$$

Building Section 2 - Transverse Direction - Second Story Braces:

Number of Braces in Transverse Direction
Braces are in tension or compression; therefore, use the total number of braces.

$$N_{2brtrans} := 6$$

Axial Stress in 5-inch STD Pipe Brace:

$$f_{2brtrans} := \frac{1}{m_{5STD}} \cdot \frac{V_{2j2trans}}{s_{br} \cdot N_{2brtrans}} \cdot \frac{L_{br}}{A_{5STD}} \qquad f_{2brtrans} = 3382 \text{ psi}$$

$$\text{if}\left(f_{2brtrans} \le F_{br}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$$

Structure is **COMPLIANT** for quick check of axial stress in transverse braces at upper level of Building Section 2.

Demand-to-Capacity Ratio:

$$DCR := \frac{f_{2brtrans}}{F_{br}} \qquad DCR = 0.188$$

Axial Stress Check in Diagonals (Continued):

Building Section 1 - Longitudinal Direction:

Average Span Length of Braced Spans:
Equals 1/2 of typical bay length
$s_{br} := \frac{L_{bay}}{2}$ $s_{br} = 12$ ft.

Height of Brace:
Equals the Story Height
$h_{br} := h_1$ $h_{br} = 13.83$ ft.

Length of Brace: $L_{br} := \sqrt{s_{br}^2 + h_{br}^2}$ $L_{br} = 18.31$ ft.

Number of Braces in Longitudinal Direction
Braces are in tension or compression; therefore, use the total number of braces.
$N_{1brlong} := 4$

Area of 4-inch STD Pipe Pipe (4" X 0.237"): $A_{4STD} := 3.17$ sq. in.

Yield strength of steel for braces F_y=36 ksi,
(See Appendix A, Figure No. 14): $F_{ybrace} := 36000$ psi

Determine Component Modification Factor for Diagonal Braces
(FEMA 310, Section 3.5.3.4, Page 3-13, Table 3-8):

Expected strength of braces is equal to 1.25 X Fybrace
(FEMA 310, Section 4.2.4.4, page 4-8)
$F_{yebrace} := 1.25 \cdot F_{ybrace}$

For 4" STD Pipe (4" X 0.237") and LS performance level

Outside diameter of pipe: $d_4 := 4.5$ in.

Thickness of pipe: $t_4 := 0.237$ in.

Diameter to thickness ratio: $\frac{d_4}{t_4} = 19.0$

$$m_4 := \mathrm{if}\left[\frac{d_4}{t_4} \le \frac{1500}{\left(\frac{F_{yebrace}}{1000}\right)}, 6.0, \mathrm{if}\left[\frac{d_4}{t_4} > \frac{6000}{\left(\frac{F_{yebrace}}{1000}\right)}, 3.0, \text{"Interpolate"}\right]\right] \qquad m_4 = 6.0$$

Axial Stress Check in Diagonals (Continued):

Building Section 1 - Longitudinal Direction (continued):

Axial Stress in 4-inch STD Pipe Brace: $f_{1brlong} := \frac{1}{m_4} \cdot \frac{V_{1long}}{s_{br} \cdot N_{1brlong}} \cdot \frac{L_{br}}{A_{4STD}}$ $f_{1brlong} = 2050$ psi

Allowable Axial Stress in Diagonals:

$F_{br} := \mathrm{if}\left(18000 > 0.5 \cdot F_{ybrace}, 0.5 \cdot F_{ybrace}, 18000\right)$ $F_{br} = 18000$ psi

$\mathrm{if}\left(f_{1brlong} \le F_{br}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$

Structure is **COMPLIANT** for quick check of axial stress in longitudinal braces of Building Section 1.

Demand-to-Capacity Ratio: $DCR := \frac{f_{1brlong}}{F_{br}}$ $DCR = 0.114$

Building Section 1 - Transverse Direction:

Number of Braces in Transverse Direction
Braces are in tension or compression; therefore, use the total number of braces. $N_{1brtrans} := 4$

Axial Stress in 4-inch STD Pipe Brace: $f_{1brtrans} := \frac{1}{m_4} \cdot \frac{V_{1trans}}{s_{br} \cdot N_{1brtrans}} \cdot \frac{L_{br}}{A_{4STD}}$ $f_{1brtrans} = 2050$ psi

$\mathrm{if}\left(f_{1brtrans} \le F_{br}, \text{"Compliant"}, \text{"Noncompliant"}\right) = \text{"Compliant"}$

Structure is **COMPLIANT** for quick check of axial stress in transverse braces of Building Section 2.

Demand-to-Capacity Ratio: $DCR := \frac{f_{1brtrans}}{F_{br}}$ $DCR = 0.114$

Appendix E -- Evaluation Phase Calculations (Tier 2)

(MathCad File BOISDOT2.MCD)

Determine Base Shear in Principal Directions:

Reference:

1997 NEHRP Recommended Provisions for Seismic Regulations for New Buildings And Other Structures, FEMA-302, February 1998, Part 1 Provisions (Part 2 Commentary, FEMA 303).

FEMA 310, Handbook for the Seismic Evaluation of Buildings -- A Prestandard, January 1998.

Given:

Lower story height; $h_1 := 13.83$ feet

Second story height: $h_2 := 12.87$ feet

Total building height: $h_{total} := h_1 + h_2$ $h_{total} = 26.7$ feet

Number of stories $N_{story} := 2$

Overall Transverse Length of Building Section 1: $L_{trans1} := 52$ feet

Overall Longitudinal Length of Building Section 1: $L_{long1} := 84$ feet

Overall Transverse Length of Building Section 2: $L_{trans2} := 72$ feet

Overall Longitudinal Length of Building Section 2: $L_{long2} := 168$ feet

Length of a Typical Bay in Longitudinal and Transverse Directions: $L_{bay} := 24$ feet

Seismic Dead Weight Excluding Partition Dead Load

(See Excel File BOISDOWT.XLS)

Total structure seismic weight of **roof** of Building Section 1 excluding partitions to be applied at roof diaphragm: $W_{seisdlrf1} := 130000$ lbs

Total structure seismic weight of **exterior walls** of Building Section 1 to be applied at roof diaphragm: $W_{seisdlwl1} := 85000$ lbs

Total structure seismic weight of **floor** of Building Section 2 excluding partitions to be applied at second floor diaphragm $W_{seisdlfl2} := 680000$ lbs

Total structure seismic weight of **exterior walls** of Building Section 2 to be applied at second floor diaphragm $W_{seisdlwlfl2} := 282000$ lbs

Total structure seismic weight of **roof** of Building Section 2 excluding partitions to be applied at roof diaphragm $W_{seisdlrf2} := 340000$ lbs

Total structure seismic weight of exterior **walls** of Building Section 2 to be applied at roof diaphragm $W_{seisdlwlrf2} := 220000$ lbs

Determine Base Shear in Principal Directions (Continued):

Per FEMA 310, Section 3.5.2.1, "W" is the total dead load and anticipated live load. "W" is comprised of:

1. In storage and warehouse occupancies, a minimum of 25% of the floor live load.
2. The actual partition weight or a minimum weight of 10 psf of floor area whichever is greater.
3. The applicable snow load.
4. The total weight of permanent equipment and furnishings.

Partition Dead Weight:

Minimum partition dead load is 10 psf per FEMA 310, Section 3.5.2.1: Since a majority of partitions are full story height, apply one half of partition load to floor below and one half to ceiling/roof above.

$w_{partitionmin} := 10$ psf

Actual Partition Dead Weights, (See Appendix D, Excel Files BOISDOPT.XLS and BOISDOWT.XLS)

Actual Partition Dead Weight For **Building Section 1** to be Applied to Roof Diaphragm:

$W_{partitionact1} := 8694$ lbs.

Minimum Partition Dead Weight for Building Section 1 to be Applied to Roof Diaphragm:

$$W_{partitionmin1} := \frac{w_{partitionmin}}{2}\cdot\left(L_{long1}\cdot L_{trans1}\right) \qquad W_{partitionmin1} = 21840 \text{ lbs.}$$

Weight of Partitions to be Used to Determine Seismic Weight to be Applied to Roof Diaphragm of Building Section 1:

$$W_{partition1} := \mathrm{if}\left(W_{partitionact1} > W_{partitionmin1}, W_{partitionact1}, W_{partitionmin1}\right)$$

$$W_{partition1} = 21840 \text{ lbs.}$$

Actual Partition Dead Weight for **Building Section 2** to be Applied at **Second Floor Diaphragm.**

$W_{partitionactsf2} := 59328$ lbs.

Minimum Partition Dead Weight for Building Section 2 to be Applied at Second Floor Diaphragm:

$$W_{partitionminsf2} := w_{partitionmin}\cdot\left(L_{long2}\cdot L_{trans2}\right) \qquad W_{partitionminsf2} = 120960 \text{ lbs.}$$

Weight of Partitions to be Used to Determine Seismic Weight to be Applied to Second Floor Diaphragm of Building Section 2:

$$W_{partitionsf2} := \mathrm{if}\left(W_{partitionactsf2} > W_{partitionminsf2}, W_{partitionactsf2}, W_{partitionminsf2}\right)$$

$$W_{partitionsf2} = 120960 \text{ lbs.}$$

Determine Base Shear in Principal Directions (continued):

Actual Partition Dead Weight for **Building Section 2** to be Applied at **Roof Diaphragm**

$W_{partitionactrf2} := 29606$ lbs.

Minimum Partition Dead Weight of Building Section 2 to be Applied at Second Floor Diaphragm

$$W_{partitionminrf2} := \frac{w_{partitionmin}}{2} \cdot \left(L_{long2} \cdot L_{trans2}\right)$$

$W_{partitionminrf2} = 60480$ lbs.

Weight of Partitions to be Used to Determine Seismic Weight to be Applied to the Roof Diaphragm of Building Section 2:

$$W_{partitionrf2} := \mathrm{if}\left(W_{partitionactrf2} > W_{partitionminrf2}, W_{partitionactrf2}, W_{partitionminrf2}\right)$$

$W_{partitionrf2} = 60480$ lbs.

Note: A minimal area of this building has fixed partitions installed; therefore, the minimum partition load controls.

Live Loading:

Building Section 2 Second Floor and Roof Full Design Unit Live Load: (for gravity loading calculation) (Appendix A, Figure No. 14 and 1997 UBC, Table 16-C, page 2-27 in Volume 2)

$w_{2fdll} := 65.0$ psf

$w_{2rdll} := 16.0$ psf

Second Floor Effective Live Load (for lateral seismic load calculation): Per FEMA 310, Section 3.5.2.1, this building is not used as a warehouse or storage; therefore, $LL_{eff} = 0$ psf

$w_{2effll} := 0.0$ psf

$W_{2EFFLL} := w_{2effll} \cdot L_{trans1} \cdot L_{long1}$

$W_{2EFFLL} = 0$ lbs.

Effect of Snow Loading (FEMA 310, Section 3.5.2.1 and 4.2.4.2):

Effective snow load: 70% of full design snow load, or where conditions warrant and approved by regulatory agency, not less than 20% of full design snow load, except where design snow is 30 psf or less, $Q_s=0.0$

Snow load for Boise ID is 25 psf per City of Boise Building Department (208) 384-3802. Per Appendix A, Figure No. 14 the original design load for the roof was 30 psf. Since both loads are equal to or less than 30 psf limit, Use $SL_{eff} = 0$ psf.

$w_{fdsl} := 30$ psf

$w_{effsl} := \mathrm{if}\left(w_{fdsl} \le 30, 0.0, 0.7 \cdot w_{fdsl}\right)$

$w_{effsl} = 0$ psf

Total roof effective snow load for Building Section 1:

$W_{EFFSL1} := w_{effsl} \cdot \left(L_{trans1} \cdot L_{long1}\right)$

$W_{EFFSL1} = 0$ lbs

Total roof effective snow load for Building Section 2:

$W_{EFFSL2} := w_{effsl} \cdot \left(L_{trans2} \cdot L_{long2}\right)$

$W_{EFFSL2} = 0$ lbs

Determine Base Shear in Principal Directions (continued):

Total Seismic Weight of Building Sections:

Combine seismic dead load, effective live load, effective snow load, and partition load.

Building Section 1:

$W_{seisrf1} := W_{seisdlrf1} + W_{seisdlwl1} + W_{partition1} + W_{EFFSL1}$ $\qquad W_{seisrf1} = 236840$ lbs

Building Section 2 Roof Diaphragm:

$W_{seisrf2} := W_{seisdlrf2} + W_{seisdlwlrf2} + W_{partitionrf2} + W_{EFFSL2}$ $\qquad W_{seisrf2} = 620480$ lbs

Building Section 2 Floor Diaphragm:

$W_{seisfl2} := W_{seisdlfl2} + W_{seisdlwlfl2} + W_{partitionsf2} + W_{2EFFLL}$ $\qquad W_{seisfl2} = 1082960$ lbs.

Total Seismic Weight of Building Section 1:

$W_{seis1} := W_{seisrf1}$ $\qquad W_{seis1} = 236840$ lbs.

Total Seismic Weight of Building Section 2:

$W_{seis2} := W_{seisrf2} + W_{seisfl2}$ $\qquad W_{seis2} = 1703440$ lbs.

Total Seismic Weight of Entire Building:

$W_{seistot} := W_{seis1} + W_{seis2}$ $\qquad W_{seistot} = 1940280$ lbs.

Determine Base Shear in Principal Directions (continued):

Level of Performance (LOP) FEMA 310, Section 1.3 and 2.4, (Page 1-6 and 2-3):

Life-Safety (LS) Performance Level --- Building performance that includes significant damage to both structural and nonstructural components during a design earthquake, though at least some margin against either partial or total structural collapse remains. Injuries may occur, but the level of risk for life threatening injury and entrapment is low.

<--- LOP

Immediate Occupancy (IO) Performance Level -- Building performance that includes very limited damage to both structural and nonstructural components during the design earthquake. The basic vertical and lateral-force-resisting systems retain nearly all of their pre-earthquake strength and stiffness. The level of risk for life threatening injury as a result of damage is very low. Although some minor repairs may be necessary, the building is fully habitable after a design earthquake, and the needed repairs may be completed while the building is occupied.

1997 NEHRP, FEMA 302, Section 2.1 Glossary (Page 7 and 10):

Design Earthquake: Earthquake effects that are two-thirds of the corresponding maximum considered earthquake.

FEMA 310, Section 1.3, page 1-6, See Maximum Considered Earthquake.

Maximum Considered Earthquake Ground Motion: The most severe earthquake effects considered by these provisions as defined in Section 4.1.

FEMA 310, Section 1.3, page 1-7, An earthquake with a 2% probability of exceedance in 50 years with deterministic-based maximum values near known fault sources.

Determine Base Shear in Principal Directions (continued):

1997 NEHRP, FEMA 302, Section 4.1 Procedures for Determining Maximum Considered Earthquake And Design Earthquake Ground Motion Accelerations And Response Spectra (Page 33):

Ground motion accelerations, represented by response spectra and coefficients derived from these spectra, shall be determined in accordance with the general procedure of Section 4.1.2 or the site-specific procedure of Section 4.1.3. The general procedure in which spectral response acceleration parameters for the maximum considered earthquake ground motions are derived using Maps 1 through 24, modified by site coefficients to include local site effects and scaled to design values, are permitted to be used for any structure except as specifically indicated in these Provisions.

1997 NEHRP, FEMA 302, Section 4.1.1 Maximum Considered Earthquake Ground Motions (Page 33):

The **maximum considered earthquake ground motions** shall be represented by the mapped spectral response acceleration at short periods ($\mathbf{S_s}$) and 1 second period ($\mathbf{S_1}$), obtained from Maps 1 through 24 of these Provisions, and adjusted for Site Class effects using the site coefficients of Section 4.1.2.4 (page 37) . See FEMA 310, Section 3.5.2.3.1, Page 3-10.

1997 NEHRP, FEMA 302, Section 4.1.2 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations (Page 33):

For structures located in those regions of the maps having values of the short period spectral acceleration, S_s, less than or equal to 0.15g and values of the 1 second period spectral response acceleration, S1, less than or equal to 0.04g, accelerations need not be determined. Such structures are permitted to be directly categorized as Seismic Design Category (SDC) A in accordance with Section 4.2.1.

For all other structures, the Site Class shall be determined in accordance with Section **4.1.2.1**. The **maximum considered earthquake** spectral response accelerations adjusted for Site Class effects, $\mathbf{S_{MS}}$ and $\mathbf{S_{M1}}$, shall be determined in accordance with Section **4.1.2.4** and the **design spectral response** accelerations at short periods, $\mathbf{S_{DS}}$, and at 1 second, $\mathbf{S_{D1}}$, shall be determined in accordance with Section **4.1.2.5.** The general response spectrum shall be determined in accordance with **Section 4.1.2.6**.

Maximum Considered Earthquake:

Map 1: Maximum Considered Earthquake Ground Motion for the U.S. for 0.2 Second Spectral Response Acceleration (%g) 5% of critical damping Site Class B.

$$S_s := \frac{35.6}{100}$$

Map 2: Maximum Considered Earthquake Ground Motion for the U.S. for 1 Second Spectral Response Acceleration (%g) 5% of critical damping Site Class B.

$$S_1 := \frac{10.9}{100}$$

State: **Idaho** County: **ADA** Zip Code: **83705**

http://geohazards.cr.usgs.gov/eq/html/zipcode.shtml @ 2% PE in 50 Year for 0.2 and 1.0 sec SA

Determine Base Shear in Principal Directions (continued):

Site Class Determination:

$S_s = 0.356$

1997 NEHRP, FEMA 302, Section 4.1.2.1, Site Class Definitions (Page 33):

$S_1 = 0.109$

For all structures located within those regions of the maps having values of the short-period spectral response acceleration, S_s, greater than 0.15g or values of the 1 second period spectral response acceleration, S1, greater than 0.04g, the site shall be classified as one of the Site Classes defined on page 34. Parameters for determining Site Class are a function of the soil shear wave velocity (V_{bars}), Standard Penetration Resistance (N_{bar}) or from soil unconfined shear strength (s_{baru}). Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions. When the soil properties are not known in sufficient detail to determine the Site Class, Site Class D shall be used. Site Classes E or F need not be assumed unless the authority having jurisdiction determines that Site Classes E or F could be present at the site or in the event that Site Class E or F are established by geotechnical data.

FEMA 310, Section 3.5.2.3.1, Site Class Definitions (Page 3-10):

The soil profile is classified as Class D based on the Geotechnical Investigation report dated June 5, 1986 prepared by Northern Engineering and Testing, Inc. for the BLM warehouse and Maintenance Building adjacent to the building being investigated in this report.

Site Class: D

Determine Base Shear in Principal Directions (continued):

1997 NEHRP, FEMA 302, Section 4.1.2.4 Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters (Page 37):

Interpolation for variable F_v w/Table 3-5

Value of Site Coefficient F_v as a Function of Site Class and Mapped 1 Second Period (S_1) Maximum Considered Earthquake Spectral Acceleration (Table 4.1.2.4b) (FEMA 310, Page 2-4 and Table 3-5, Page 3-10):

$S_{1L} := 0.1$ $F_{vL} := 2.4$

$S_1 = 0.109$

$S_{1H} := 0.2$ $F_{vH} := 2.0$

$$F_v := \frac{F_{vH} - F_{vL}}{S_{1H} - S_{1L}} \cdot \left(S_1 - S_{1L}\right) + F_{vL} \qquad F_v = 2.364$$

Interpolation for variable F_a w/Table 3-6

Value of Site Coefficient F_a as a Function of Site Class and Mapped Short Periods (S_s) Maximum Considered Earthquake Spectral Acceleration (Table 4.1.2.4a) (FEMA 310, Page 2-4 and Table 3-6, Page 3-10):

$S_{sL} := 0.25$ $F_{aL} := 1.6$

$S_s = 0.356$

$S_{sH} := 0.50$ $F_{aH} := 1.4$

$$F_a := \frac{F_{aH} - F_{aL}}{S_{sH} - S_{sL}} \cdot \left(S_s - S_{sL}\right) + F_{aL} \qquad F_a = 1.515$$

1997 NEHRP, FEMA 302, Section 4.1.2.4 Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters (Page 37):

Equation 4.1.2.4-1: $S_s = 0.356$ $S_{MS} := F_a \cdot S_s$ $S_{MS} = 0.54$

Equation 4.1.2.4-2: $S_1 = 0.109$ $S_{M1} := F_v \cdot S_1$ $S_{M1} = 0.258$

Determine Base Shear in Principal Directions (continued):

1997 NEHRP, FEMA 302, Section 4.1.2.5 Design Spectral Response Acceleration Parameters (Page 38):

Design earthquake spectral response acceleration at short periods, S_{DS}, and at 1 second, S_{D1}, shall be determined from formulas 4.1.2.5-1 and 4.1.2.5-2.

1997 NEHRP, FEMA 302, Equation 4.1.2.5-1, Page 38 :
(FEMA 310, Section 3.5.2.3.1, Equation 3-6, page 3-9)

$$S_{DS} := \frac{2}{3} \cdot S_{MS} \qquad S_{DS} = 0.36$$

1997 NEHRP, FEMA 302, Equation 4.1.2.5-2, Page 38 :
(FEMA 310, Section 3.5.2.3.1, Equation 3-5, page 3-9)

$$S_{D1} := \frac{2}{3} \cdot S_{M1} \qquad S_{D1} = 0.17$$

FEMA 310, Section 2.5, Table 2-1, Region of Seismicity (Page 2-4):

The highest region of seismicity defined by S_{DS} or S_{D1} shall govern.

S_{DS} -- **Moderate**

S_{D1} -- **Moderate**

Region of Seismicity -------> Moderate

Determine Building Type Rigid or Flexible Diaphragm): Is the floor diaphragm considered a rigid or a flexible diaphragm? ("Design of Low-Rise Concrete Buildings for Earthquake Forces", Second Edition, pg. 4-2 and Chapter 5 of the "Seismic Design for Buildings, Departments of the Army, The Navy, and the Air Force", October 1992, Army TM 5-809-10, NAVY NAVFAC P-355, Air Force AFM 88-3, Chapter 13. -- See Rodney Barthel D8110 for manuals)

Thickness of slab:	$h_{slab} := 4.5$	in.
Unit Weight of Concrete:	$w_c := 150$	lbs./cu. ft.
Concrete Strength: (Appendix A, Figure No. 14)	$f_c := 3000$	psi

Flexibility Factor:

$$F := \frac{10^6}{8.5 \cdot h_{slab} \cdot w_c^{1.5} \cdot \sqrt{f_c}} \qquad F = 0.26$$

if(F< 1.0, "Rigid Diaphragm" , "See Table 4-1") = "Rigid Diaphragm"

Determine Base Shear in Principal Directions (continued):

FEMA 310, Section 3.5.2.4, Period (Page 3-11):

The structure consists of steel braced frames in both the transverse and longitudinal directions; therefore, the structure will be evaluated as a Type S2 (Steel Braced Frames with Rigid Diaphragms) in both directions.

Longitudinal Period Equation Coefficient (**Steel Braced Frame with Rigid Diaphragms, Building Type S2**): $C_{Tlong} := 0.030$

Transverse Period Equation Coefficient (**Steel Braced Frame with Rigid Diaphragms, Building Type S2**): $C_{Ttrans} := 0.030$

Height in feet above the base to the roof level of the building:

$h_n := h_1 + h_2$ $h_n = 26.7$ feet

Longitudinal Orthogonal Direction:

Fundamental period (1997 NEHRP, FEMA 302, Equation 5.3.3.1-1, page 67) or FEMA 310, Section 3.5.2.4, Equation 3-7, page 3-11

$T_{along} := C_{Tlong} \cdot h_n^{\frac{3}{4}}$ $T_{along} = 0.352$ seconds

Transverse Orthogonal Direction:

$T_{atrans} := C_{Ttrans} \cdot h_n^{\frac{3}{4}}$ $T_{atrans} = 0.352$ seconds

Mapped Spectral Acceleration, FEMA 310, Section 3.5.2.3.1, Equation 3-4, Page 3-9:

$S_{D1} = 0.17$ $S_{DS} = 0.36$ $S_{along} := \frac{S_{D1}}{T_{along}}$ $S_{atrans} := \frac{S_{D1}}{T_{atrans}}$

$S_{along} = 0.488$ $S_{along} := \mathrm{if}(S_{along} > S_{DS}, S_{DS}, S_{along})$ $S_{along} = 0.36$

$S_{atrans} = 0.488$ $S_{atrans} := \mathrm{if}(S_{atrans} > S_{DS}, S_{DS}, S_{atrans})$ $S_{atrans} = 0.36$

Determine Base Shear in Principal Directions (continued):

FEMA 310, Section 3.5.2.1 Calculation of Modification Factor (Page 3-8):

The modification factor to relate expected maximum inelastic displacements to displacements calculated for linear elastic response; C shall be taken from FEMA 310, Table 3-4. The "C" value for Building Type S2 (Steel Braced Frame with Rigid Diaphragm) is 1.2 and the "C" value for Building Type S2A (Steel Braced Frame with Flexible Diaphragms) is 1.0. This building consists of a flexible diaphragm at the roof level and a rigid diaphragm at the second floor level. Use C=1.2 for analysis. This will create the highest pseudo lateral force.

Number of stories $N_{story} = 2$

Modification factor for **transverse** direction Building Type **S2** $C_{trans} := 1.2$

Modification factor for **longitudinal** direction Building Type **S2** $C_{long} := 1.2$

Pseudo Lateral Force Factor:

Transverse Direction: $C_{trans} \cdot S_{atrans} = 0.432$

Longitudinal Direction: $C_{long} \cdot S_{along} = 0.432$

FEMA 310, Section 3.5.2.1 Pseudo Lateral Force (Equation 3-1, Page 3-8):

Method 1 for Building Section 1:

Transverse Direction: $V_{1trans} := C_{trans} \cdot S_{atrans} \cdot W_{seis1}$ $V_{1trans} = 102203$ lbs

Longitudinal Direction: $V_{1long} := C_{long} \cdot S_{atrans} \cdot W_{seis1}$ $V_{1long} = 102203$ lbs

Method 1 for Building Section 2:

Transverse Direction: $V_{2trans} := C_{trans} \cdot S_{atrans} \cdot W_{seis2}$ $V_{2trans} = 735084$ lbs

Longitudinal Direction: $V_{2long} := C_{long} \cdot S_{atrans} \cdot W_{seis2}$ $V_{2long} = 735084$ lbs

Checker Note of Rodney Barthel September 17, 1999: The single story Building Section 1 would have a slightly different fundamental period than the two story Building Section 2, but S_a would default to the controlling S_{DS} for the force factor calculation. However, C = 1.4 for a single story and would change results to force factor of 1.4 * 0.36 = 0.50 versus 0.43.

$V_{check} := 1.4 \cdot \left(S_{atrans} \cdot W_{seis1} \right)$ $V_{check} = 119237$ $V_{check} - V_{1trans} = 17034$ pounds to be resisted

$$\frac{V_{check} - V_{1trans}}{V_{1trans}} \cdot 100 = 16.7 \text{ percent}$$

Determine Base Shear in Principal Directions (continued):

NOTE: Alternatively, for buildings with shallow foundations and without basements being evaluated for Life-Safety Performance Level, FEMA 310, Equation 3-2, may be used to compute the pseudo lateral force. An *m*-factor of 1.0 shall be used to compute the component forces and stresses for the Quick Check of Sections 3.5.3 and acceptance criteria of Section 4.2.4.

FEMA 310, Section 3.5.2.1 Pseudo Lateral Force (Equation 3-1, Page 3-8):

Method 2:

$$V_{2trans} = 0.75 \text{ X } W_{seis}$$

Determine ratio of base shear factors for Method 1 vs. Method 2:

$$ratio := \frac{C_{trans} \cdot S_{atrans}}{0.75} \qquad ratio = 0.575$$

Note: Selecting the smaller of the two base shear factors calculated above may not be an accurate way of determining the controlling base shear force. Method 1 uses m-factors that can be significantly greater than 1.0, and Method 2 uses a m-factors equal to 1.0. An analysis would be required comparing results of both methods for the component being evaluated. Engineering judgment can be used based on inspection of base shear factors and m-factors being used for the component being evaluated (e.g., See FEMA 310, page A-71, for Appendix A Examples, Example 6).

The typical m-factor used in Method 1 for braced frames would be a minimum of 3.0. The m-factor used for Method 2 is 1.0. Since the ratio of base shear factors is less than the m-factor used for Method 1, the pseudo lateral force determined by Method 1 controls.

Pseudo Lateral Force for Building Section 1

$V_{1trans} = 102203$ lbs. $\qquad V_{1long} = 102203$ lbs.

Pseudo Lateral Force for Building Section 2

$V_{2trans} = 735084$ lbs. $\qquad V_{2long} = 735084$ lbs.

Determine Component Gravity Loads for Typical Longitudinal Braced Frame of Building Section 2:

Load Case Combinations FEMA 310, Section 4.2.4.2, pg. 4-6

Component gravity loads shall be calculated in accordance with Equations (4-6) and (4-7)

$Q_G = 1.1(Q_D + Q_L + Q_S)$ (Equation 4-6)

$Q_G = 0.9Q_D$ (Equation 4-7)

Effect of Dead Loading (Q_D) Dead Load tributary to a typical longitudinal frame.
Building Line A. See Appendix D, Excel Spreadsheet (BOISDOWT.XLS) for Dead Load Calculations:

Total dead weight of second floor. Floor weight only, building frame does not carry the wall weight: $W_{seisdlfl2} = 680000$ lbs

Unit dead weight of second floor: $w_{fl2dl} := \frac{W_{seisdlfl2}}{L_{long2} \cdot L_{trans2}}$ $w_{fl2dl} = 56.2$ psf

Uniform dead load to apply to floor beams. Tributary area is 1/2 of typical bay. Include minimum partition load of 10 psf: $Q_{D2longflbm} := (w_{fl2dl} + 10) \cdot \frac{L_{bay}}{2}$ $Q_{D2longflbm} = 794.6$ plf

Round to 0.8 klf and apply to each longitudinal floor beam.

Total dead weight of roof. Roof weight only, building frame does not carry the wall weight: $W_{seisdlrf2} = 340000$ lbs

Unit dead weight of roof: $w_{rf2dl} := \frac{W_{seisdlrf2}}{L_{long2} \cdot L_{trans2}}$ $w_{rf2dl} = 28.1$ psf

Uniform dead load to apply to roof beams. Tributary area is 1/2 of typical bay: $Q_{D2longrfbm} := w_{rf2dl} \cdot \left(\frac{L_{bay}}{2}\right)$ $Q_{D2longrfbm} = 337.3$ plf

Round to 0.4 klf and apply to each longitudinal roof beam.

Effect of Live Loading (Q_L):

Full design live load for second floor: $w_{2fdll} = 65$ psf

Effective live load for second floor, equal to 25% of full design live load (FEMA 310, Section 4.2.4.2): $w_{2effll} := 0.25 \cdot w_{2fdll}$ $w_{2effll} = 16.25$ psf

Uniform live load to apply to floor beams. Tributary area is 1/2 of typical bay: $Q_{L2longflbm} := w_{2effll} \cdot \left(\frac{L_{bay}}{2}\right)$ $Q_{L2longflbm} = 195.0$ plf

Round to 0.2 klf and apply to each longitudinal floor beam.

Determine Component Gravity Loads for Typical Longitudinal Braced Frame of Building Section 2 (Continued):

Load Case Combinations (Continued)

Note Checker RJB, 18 September 1999: If there was no observed roof LL during field inspection then actual roof LL = 0 psf. OK

Effect of Snow Loading (Q_S):

Effective snow load for roof: $w_{effsl} = 0$ psf

Uniform snow load to apply to roof beams: $Q_{S2longrfbm} := w_{effsl} \cdot \left(\frac{L_{bay}}{2} \right)$ $Q_{S2longrfbm} = 0.0$ plf

Effect of Seismic Forces (Lateral Forces) (Q_E):

Note: For multi-story buildings, the pseudo lateral force computed in accordance with Section 4.2.2.1.1 shall be distributed vertically in accordance with Section 4.2.2.1.2, Equations 4-2 & 4-3.

Partial Equation Calculation ($W_i h_i^k$), Foot-Pounds (FEMA 310 Equation 4-3, page 4-3):

Vertical Distribution Factor (C_{vx}) (continued):

Longitudinal Direction:

$T_{low} := 0.5$ $T_{high} := 2.5$ $T_{along} = 0.352$ $k_{low} := 1$ $k_{high} := 2$

k is an exponent related to the building period.

For buildings having a period of 0.5 seconds or less k = 1

For buildings having a period of 2.5 seconds or more k= 2

$k_{interp} := \left(\frac{k_{high} - k_{low}}{T_{high} - T_{low}} \right) \cdot \left(T_{along} - T_{low} \right) + k_{low}$ $k_{interp} = 0.926$

$k_{long} := \mathrm{if}\left(T_{along} \le 0.5, 1, \mathrm{if}\left(T_{along} > 2.5, 2, k_{interp} \right) \right)$ $k_{long} = 1$

Floor Level: $w_{21h1long} := W_{seisfl2} \cdot h_1^{k_{long}}$ $w_{21h1long} = 14977337$

Roof Level: $w_{22h2long} := W_{seisrf2} \cdot \left(h_1 + h_2 \right)^{k_{long}}$ $w_{22h2long} = 16566816$

NOTE: hi and hx the height (feet) from the base to Level i or x. wi and wx the portion of the total gravity load of the building (W) located or assigned to Level i or x.

$sumw_{2ihilong} := w_{21h1long} + w_{22h2long}$ $sumw_{2ihilong} = 31544153$

Vertical distribution factor for second floor diaphragm: $C_{2v1long} := \frac{W_{seisfl2} \cdot \left(h_1 \right)^{k_{long}}}{sumw_{2ihilong}}$ $C_{2v1long} = 0.475$

Vertical distribution factor for roof diaphragm: $C_{2v2long} := \frac{W_{seisrf2} \cdot \left(h_1 + h_2 \right)^{k_{long}}}{sumw_{2ihilong}}$ $C_{2v2long} = 0.525$

Determine Component Gravity Loads for Typical Longitudinal Braced Frame of Building Section 2 (Continued):

FEMA 310, Section 4.2.2.1.2 Story Forces, F_x (Equation 4-2, Page 4-3):

Determine lateral story force, F_X (Note that story shears are the sum of story forces from stories above):

Per FEMA-310 Eqn. (4-2): $F_x=C_{vx}V$

Lateral force at floor diaphragm: $Q_{E2fllong} := C_{2v1long} \cdot V_{2long}$

$Q_{E2fllong} = 349022$ lbs **<--- Apply @ Building Floor Diaphragm**

This is the lateral force for the entire floor. Due to the symmetry of the floor diaphragm in the longitudinal direction of the building, apply 1/2 of this load to each longitudinal braced frame.

$\frac{Q_{E2fllong}}{2} = 174511$ lbs **<--- Apply to Each Braced Frame @ Floor Diaphragm**

Round to 175 kips and apply to braced frame at second floor level.

Lateral force at roof diaphragm: $Q_{E2rflong} := C_{2v2long} \cdot V_{2long}$

$Q_{E2rflong} = 386062$lbs **<--- Apply @ Building Roof Diaphragm**

This is the lateral force for the entire roof. Due to the symmetry of the roof diaphragm in the longitudinal direction of the building, apply 1/2 of this load to each longitudinal braced frame.

$\frac{Q_{E2rflong}}{2} = 193031$ lbs **<--- Apply to Each Braced Frame @ Roof Diaphragm**

Round to 194 kips and apply to braced frame at roof level.

Note: The Braced frame for longitudinal direction of Building Section 2 could be either the frame at building line A or D.

Determine Component Gravity Loads for Typical Transverse Braced Frame of Building Section 2:

Load Case Combinations FEMA 310, Section 4.2.4.2, pg. 4-6

Component gravity loads shall be calculated in accordance with Equations (4-6) and (4-7)

$Q_G=1.1(Q_D+Q_L+Q_S)$ (Equation 4-6)

$Q_G=0.9Q_D$ (Equation 4-7)

Effect of Dead Loading (Q_D) Dead Load tributary to a typical interior transverse frame. Building Line 5. See Excel Spreadsheet (BOISDOWT.XLS) for Dead Loads:

Unit dead weight of second floor: $w_{fl2dl} = 56.2$ psf

Due to the direction of span for the floor and roof decking, the transverse floor and roof beams support load from a tributary area equal to the typical intermediate beam spacing.

Typical intermediate beam spacing: $L_{spcg} := 8.0$ ft.

Uniform dead load to apply to floor beams. Include minimum partition load of 10 psf. $Q_{D2transflbm} := \left(w_{fl2dl} + 10\right)\cdot L_{spcg}$ $Q_{D2transflbm} = 529.7$ plf

Round to 0.6 klf and apply to each transverse floor beam.

Unit dead weight of roof: $w_{rf2dl} = 28.1$ psf

Uniform dead load to apply to roof beams: $Q_{D2transrfbm} := w_{rf2dl}\cdot L_{spcg}$ $Q_{D2transrfbm} = 224.9$ plf

Round to 0.3 klf and apply to each transverse roof beam.

Concentrated dead load to apply to a column. Interior column 24' X 24'. Corner column 12' X 12'. $Q_{D2col} := \left(w_{fl2dl} + w_{rf2dl}\right)\cdot 24\cdot 24$ $Q_{D2col} = 48571$ lbs

Apply 50.0 kips to interior columns and 25.0 kips to exterior columns.

Determine Component Gravity Loads for Typical Transverse Braced Frame of Building Section 2 (Continued):

Effect of Live Loading (Q_L):

Effective live load for second floor, equal to 25% of full design live load (FEMA 310, Section 4.2.4.2):

$w_{2effll} = 16.25$ psf

Uniform live load to apply to floor beams:

$Q_{L2transflbm} := w_{2effll} \cdot L_{spcg}$ $\quad Q_{L2transflbm} = 130.0$ plf

Round to 0.2 klf and apply to each transverse floor beam.

Concentrated live load to apply to a column. Interior column 24' X 24'. Corner column 12' X 12'.

$Q_{L2col} := \left(w_{2effll} + w_{effsl}\right) \cdot 24 \cdot 24$ $\quad Q_{L2col} = 9360$ lbs

Apply 10.0 kips to interior columns and 5.0 kips to exterior columns.

Effect of Snow Loading (Q_S):

Effective snow load for roof:

$w_{effsl} = 0$ psf

Uniform snow load to apply to roof beams:

$Q_{S2transrfbm} := w_{effsl} \cdot L_{spcg}$ $\quad Q_{S2transrfbm} = 0.0$ plf

Effect of Seismic Forces (Lateral Forces) (Q_E):

Note: For multi-story buildings, the pseudo lateral force computed in accordance with Section 4.2.2.1.1 shall be distributed vertically in accordance with Section 4.2.2.1.2, Equation 4-3.

Partial Equation Calculation ($W_i h_i^k$), Foot-Pounds (FEMA 310 Equation 4-3, page 4-3):

Vertical Distribution Factor (C_{vx}):

Transverse Direction:

$T_{low} := 0.5 \quad T_{high} := 2.5 \quad T_{atrans} = 0.352 \quad k_{low} := 1 \quad k_{high} := 2$

k is an exponent related to the building period.

For buildings having a period of 0.5 seconds or less k = 1

For buildings having a period of 2.5 seconds or more k= 2

$$k_{interp} := \left(\frac{k_{high} - k_{low}}{T_{high} - T_{low}}\right) \cdot \left(T_{atrans} - T_{low}\right) + k_{low} \qquad k_{interp} = 0.926$$

$$k_{trans} := \mathrm{if}\left(T_{atrans} \le 0.5, 1, \mathrm{if}\left(T_{atrans} > 2.5, 2, k_{interp}\right)\right) \qquad k_{trans} = 1$$

Determine Component Gravity Loads for Transverse Braced Frame of Building Section 2 (Continued):

Effect of Seismic Forces (Lateral Forces) (Q_E) (Continued):

Lower story height: $h_1 = 13.83$ ft.

Lower story seismic weight: $W_{seisfl2} = 1082960$ lbs.

Second story height: $h_2 = 12.87$ ft.

Second story seismic weight: $W_{seisrf2} = 620480$ lbs.

$w_{21h1trans} := W_{seisfl2} \cdot h_1^{k_{trans}}$ $\quad w_{21h1trans} = 14977337$

NOTE: hi and hx the height (feet) from the base to Level i or x. wi and wx the portion of the total gravity load of the building (W) located or assigned to Level i or x.

$w_{22h2trans} := W_{seisrf2} \cdot \left(h_1 + h_2\right)^{k_{trans}}$ $\quad w_{22h2trans} = 16566816$

$sumw_{2ihitrans} := w_{21h1trans} + w_{22h2trans}$ $\quad sumw_{2ihitrans} = 31544153$

Vertical distribution factor for floor diaphragm:

$$C_{2v1trans} := \frac{W_{seisfl2} \cdot \left(h_1\right)^{k_{trans}}}{sumw_{2ihitrans}} \qquad C_{2v1trans} = 0.475$$

Vertical distribution factor for roof diaphragm:

$$C_{2v2trans} := \frac{W_{seisrf2} \cdot \left(h_1 + h_2\right)^{k_{trans}}}{sumw_{2ihitrans}} \qquad C_{2v2trans} = 0.525$$

Lateral force at floor diaphragm:

$Q_{E2fltrans} := C_{2v1trans} \cdot V_{2trans}$

$Q_{E2fltrans} = 349022$ lbs **<--- Apply @ Building Floor Diaphragm**

NOTE: This is the lateral force for the entire floor. There are three braced frames in the transverse direction. Two are on exterior of building and one is internal. The internal frame (5-line) is not located symmetrically within the building. Assume that this internal frame takes 1/2 of the lateral force. Rather than performing a detailed analysis of the distribution of the lateral force due to this eccentricity, increase 20% to account for any eccentricity.

$\frac{Q_{E2fltrans}}{2} \cdot 1.2 = 209413$ lbs **<--- Apply to Each Braced Frame @ Floor Diaphragm**

Round to 210 kips and apply to braced frame at floor level.

Lateral force at roof diaphragm:

$Q_{E2rftrans} := C_{2v2trans} \cdot V_{2trans}$

$Q_{E2rftrans} = 386062$ lbs **<--- Apply @ Building Roof Diaphragm**

$\frac{Q_{E2rftrans}}{2} \cdot 1.2 = 231637$ lbs **<--- Apply to Each Braced Frame @ Roof Diaphragm**

Round to 232 kips and apply to braced frame at roof level.

Determine Component Gravity Loads for Longitudinal Frame of Building Section 1:

Load Case Combinations FEMA 310, Section 4.2.4.2, pg. 4-6

Component gravity loads shall be calculated in accordance with Equations (4-6) and (4-7)

$Q_G=1.1(Q_D+Q_L+Q_S)$ (Equation 4-6)

$Q_G=0.9Q_D$ (Equation 4-7)

Effect of Dead Loading (Q_D) Dead Load tributary to a typical longitudinal frame. Building Line G. See Excel Spreadsheet (BOISDOWT.XLS) for Dead Loads:

Total dead weight of roof: $W_{seisdlrf1} = 130000$ lbs

Unit dead weight of roof: $w_{rf1dl} := \frac{W_{seisdlrf1}}{\left(L_{long1} \cdot L_{trans1}\right)}$ $w_{rf1dl} = 29.8$ psf

Uniform dead load to apply to roof beams. Tributary area is 1/2 of a typical bay. $Q_{D1longrfbm} := w_{rf1dl} \cdot \frac{L_{bay}}{2}$ $Q_{D1longrfbm} = 357.1$ plf

Round to 0.4 klf and apply to each longitudinal roof beam.

Effect of Live Loading (Q_L):

Full design live load for roof: $w_{1fdll} := 0.0$ psf

Effect of Snow Loading (Q_S):

Effective snow load for roof: $w_{effsl} = 0$ psf

Uniform snow load to apply to roof beams: $Q_{S1longrfbm} := w_{effsl} \cdot \frac{L_{bay}}{2}$ $Q_{S1longrfbm} = 0.0$ plf

Determine Component Gravity Loads for Longitudinal Frame of Building Section 1 (Continued):

Effect of Seismic Forces (Lateral Forces) (Q_E):

Note: For multi-story buildings, the pseudo lateral force computed in accordance with Section 4.2.2.1.1 shall be distributed vertically in accordance with Section 4.2.2.1.2, Equation 4-3.

Partial Equation Calculation ($W_i h_i^k$), Foot-Pounds (FEMA 310 Equation 4-3, page 4-3):

Vertical Distribution Factor (C_{vx}):

Longitudinal Direction:

$T_{low} := 0.5 \quad T_{high} := 2.5 \quad T_{atrans} = 0.352 \quad k_{low} := 1 \quad k_{high} := 2$

$k_{interp} := \left(\frac{k_{high} - k_{low}}{T_{high} - T_{low}}\right) \cdot \left(T_{atrans} - T_{low}\right) + k_{low} \qquad k_{interp} = 0.926$

k is an exponent related to the building period.

For buildings having a period of 0.5 seconds or less k = 1

For buildings having a period of 2.5 seconds or more k= 2

$k_{long} := \mathrm{if}\left(T_{along} \le 0.5, 1, \mathrm{if}\left(T_{along} > 2.5, 2, k_{interp}\right)\right) \qquad k_{long} = 1$

For the single story section, story height equals building height: $h_1 = 13.83$ ft.

For the single story section, story seismic weight equals the seismic weight of roof: $W_{seisrf1} = 236840$ lbs.

$w_{11h1long} := W_{seisrf1} \cdot h_1^{\,k_{long}} \qquad w_{11h1long} = 3275497$

NOTE: hi and hx the height (feet) from the base to Level i or x. wi and wx the portion of the total gravity load of the building (W) located or assigned to Level i or x.

$sumw_{1ihilong} := w_{11h1long} \qquad sumw_{1ihilong} = 3275497$

Vertical distribution factor for single story: $C_{1v1long} := \frac{W_{seisrf1} \cdot \left(h_1\right)^{k_{long}}}{sumw_{1ihilong}} \qquad C_{1v1long} = 1$

Lateral force at roof diaphragm: $Q_{E1rflong} := C_{1v1long} \cdot V_{1long}$

$Q_{E1rflong} = 102203$ lbs. **<--- Apply @ Building Roof Diaphragm**

This is the lateral force for the entire roof. Due to the symmetry of the roof diaphragm in the longitudinal direction of the building, apply 1/2 of this load to each longitudinal braced frame.

$\frac{Q_{E1rflong}}{2} = 51102$ lbs **<--- Apply to Each Braced Frame @ Roof Diaphragm**

Round to 52 kips and apply to braced frame at roof level.

Building Section 2 - Longitudinal Braced Frame:

Determine Component Strength -- First Story Brace

Per FEMA 310, Section 4.2.4.3, Braces are Deformation Controlled elements. Determine the Design Axial Strength per LRFD, 2nd Ed., Sections E1 & E2. Depending on the direction of the ground motion, braces can experience tension or compression loads. Determine component strength based on compression condition which is more critical due to effective length. Design by plastic analysis is permitted if the column slenderness parameter λ_c does not exceed 1.5K. The design strength for flexural buckling of compression members whose elements have width-thickness ratios less than λ_r from Section B5.1 is ϕPn. The factor ϕ_c = 0.85, but per FEMA 310, Section 4.2.4.4, Commentary, ϕ =1.

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Yield strength of steel for braces F_y=36 ksi, (See Appendix A, Figure No. 14): $F_{ybrace} := 36.0$ ksi

Average Span Length of Braced Spans: Equals 1/2 of typical bay length $s_{br} := \frac{L_{bay}}{2}$ $s_{br} = 12$ ft.

Height of Brace: Equals the Story Height $h_{br} := h_1$ $h_{br} = 13.83$ ft.

Length of Brace: $L_{br} := \sqrt{s_{br}^2 + h_{br}^2}$ $L_{br} = 18.31$ ft.

Effective Length Factor of Brace: (pin - pin) $K := 1.0$

For 6" STD Pipe (6" X 0.280"):

Area of pipe: $A_{6STD} := 5.58$ sq.in.

Outside diameter of pipe: $d_{6STD} := 6.625$ in.

Thickness of pipe: $t_{6STD} := 0.280$ in.

Diameter to thickness ratio: $\frac{d_{6STD}}{t_{6STD}} = 23.7$

Radius of gyration: $r_{6STD} := 2.25$ in.

Diameter to thickness ratio of pipe: Must be less than λ_r as given in LRFD Table B5.1 in order for E2 to apply. $\frac{d_{6STD}}{t_{6STD}} = 23.7$ $\frac{3300}{F_{ybrace}} = 91.7$

$$\text{Result} := \text{if}\left(\frac{d_{6STD}}{t_{6STD}} < \frac{3300}{F_{ybrace}}, \text{"OK. E2 is Applicable"}, \text{" E2 is Not Applicable"}\right)$$ Result = "OK. E2 is Applicable"

Building Section 2 - Longitudinal Braced Frame (Continued):

Determine Component Strength -- First Story Brace (Continued)

LRFD, Section E2: $\lambda_c := \frac{K \cdot L_{br} \cdot 12}{r_{6STD} \cdot \pi} \cdot \sqrt{\frac{F_{ybrace}}{29000}}$ $\lambda_c = 1.095$

$0.658^{\lambda_c^2} \cdot F_{ybrace} = 21.79$ $\frac{0.877}{\lambda_c^2} \cdot F_{ybrace} = 26.321$

$F_{cr6STD} := \mathrm{if}\left(\lambda_c \le 1.5, 0.658^{\lambda_c^2} \cdot F_{ybrace}, \frac{0.877}{\lambda_c^2} \cdot F_{ybrace}\right)$ $F_{cr6STD} = 21.79$ ksi

Nominal Strength:

$P_n = A_g F_{cr}$ $P_{n6STD} := F_{cr6STD} \cdot A_{6STD}$ $P_{n6STD} = 121.6$ kips

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9,
The expected strength is equal to 1.25 x Nominal Strength:

$Q_{CE6STD} := 1.25 \cdot P_{n6STD}$ $Q_{CE6STD} = 152$ kips

Building Section 2 - Longitudinal Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis -- First Story Brace (Continued)

See STAAD File BOISDOL2.ANL Output for Member No. 36, Axial Load in Local X-axis.

Brace Axial Load Component Forces:

Dead Load Axial Force: $Q_{Dp36} := 7.9$ kips

Live Load Axial Force: $Q_{Lp36} := 2.0$ kips

Snow Load Axial Force: $Q_{Sp36} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep36} := 283.0$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p36} := 1.1 \cdot \left(Q_{Dp36} + Q_{Lp36} + Q_{Sp36}\right)$ $Q_{G46p36} = 10.9$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p36} := 0.9 \cdot Q_{Dp36}$ $Q_{G47p36} = 7.1$ kips

Action Due to Combined Gravity Plus Earthquake Forces; FEMA 310, (Eq. 4-8) $Q_{UD} = Q_G$ +/- Q_E:

$$Q_{UDp36} := \mathrm{if}\left(Q_{G46p36} \ge Q_{G47p36}, Q_{G46p36} + Q_{Ep36}, Q_{G47p36} + Q_{Ep36}\right)$$

$Q_{UDp36} = 293.9$ kips **<---- Brace compression axial load deformation-controlled design action**

Building Section 2 - Longitudinal Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis -- First Story Brace (Continued)

Acceptance Criteria:

Axial Demand: $Q_{UDp36} = 293.9$ kip

Expected Axial Capacity: $Q_{CE6STD} = 152$ kip

Determine Component Modification Factor for Diagonal Braces
(FEMA 310, Section 3.5.3.4, Page 4-16, Table 4-3):

Expected yield strength of braces is equal to 1.25 X F_{ybrace}
(FEMA 310, Section 4.2.4.4, page 4-8)

$$F_{yebrace} := 1.25 \cdot F_{ybrace}$$

$$F_{yebrace} = 45.0 \quad \text{ksi.}$$

For circular section in compression:

$$m_{6STD} := \text{if}\left(\frac{d_{6STD}}{t_{6STD}} \le \frac{1500}{F_{yebrace}}, 6.0, \text{if}\left(\frac{d_{6STD}}{t_{6STD}} > \frac{6000}{F_{yebrace}}, 3.0, \text{"Interpolate"}\right)\right) \qquad m_{6STD} = 6.0$$

FEMA 310, Eq. (4-12):

$$\frac{Q_{UDp36}}{m_{6STD}} = 49$$

$$\text{if}\left(Q_{CE6STD} \ge \frac{Q_{UDp36}}{m_{6STD}}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand-to-Capacity Ratio for Brace in Building Section 2 Longitudinal Frame:

$$DCR_{p36} := \frac{\left(\frac{Q_{UDp36}}{m_{6STD}}\right)}{Q_{CE6STD}} \qquad DCR_{p36} = 0.32$$

Building Section 2 - Longitudinal Braced Frame:

Determine Component Strength -- Second Story Brace

Per FEMA 310, Section 4.2.4.3, Braces are Deformation Controlled elements. Determine the Design Axial Strength per LRFD, 2nd Ed., Sections E1 & E2. Depending on the direction of the ground motion, braces will experience tension or compression loads. Determine component strength based on compression condition which is more critical due to effective length. Design by plastic analysis is permitted if the column slenderness parameter λ_c does not exceed 1.5K. The design strength for flexural buckling of compression members whose elements have width-thickness ratios less than λ_r from Section B5.1 is ϕPn. The factor $\phi_c = 0.85$, but per FEMA 310, Section 4.2.4.4, Commentary, $\phi = 1$.

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Average Span Length of Braced Spans:
Equals 1/2 of typical bay length $\quad s_{br} := \frac{L_{bay}}{2} \quad s_{br} = 12$ ft.

Height of Brace:
Equals the Story Height $\quad h_{br} := h_2 \quad h_{br} = 12.87$ ft.

Length of Brace: $\quad L_{br} := \sqrt{s_{br}^2 + h_{br}^2} \quad L_{br} = 17.6$ ft.

Effective Length Factor of Brace $\quad K := 1.0$

For 5" STD Pipe (5" X 0.258"):

Area of pipe: $A_{5STD} := 4.3$ sq.in.

Outside diameter of pipe: $d_{5STD} := 5.563$ in.

Thickness of pipe: $t_{5STD} := 0.258$ in.

Diameter to thickness ratio: $\frac{d_{5STD}}{t_{5STD}} = 21.6$

Radius of gyration: $r_{5STD} := 1.88$ in.

Diameter to thickness ratio of pipe:
Must be less than λ_r as given in LRFD
Table B5.1 in order for E2 to apply. $\quad \frac{d_{5STD}}{t_{5STD}} = 21.6 \quad \frac{3300}{F_{ybrace}} = 91.7$

$$Result := if\left(\frac{d_{5STD}}{t_{5STD}} < \frac{3300}{F_{ybrace}}, \text{"OK, E2 is Applicable"}, \text{" E2 is Not Applicable"}\right) \quad Result = \text{"OK, E2 is Applicable"}$$

Building Section 2 - Longitudinal Braced Frame (Continued):

Determine Component Strength -- Second Story Brace (Continued):

LRFD, Section E2: $\lambda_c := \dfrac{K \cdot L_{br} \cdot 12}{r_{5STD} \cdot \pi} \cdot \sqrt{\dfrac{F_{ybrace}}{29000}}$ $\lambda_c = 1.26$

$$F_{cr5STD} := \mathrm{if}\left[\lambda_c \le 1.5, \left(0.658^{\lambda_c^{2}}\right) \cdot F_{ybrace}, \left(\frac{0.877}{\lambda_c^{2}}\right) \cdot F_{ybrace}\right] \qquad F_{cr5STD} = 18.53 \text{ ksi}$$

Nominal Strength:

$P_n = A_g F_{cr}$ $P_{n5STD} := F_{cr5STD} \cdot A_{5STD}$ $P_{n5STD} = 79.7$ kips

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9,
The expected strength is equal to 1.25 x Nominal Strength:

$Q_{CE5STD} := 1.25 \cdot P_{n5STD}$ $Q_{CE5STD} = 99.6$ kips

Building Section 2 - Longitudinal Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis - Second Story Brace

See STAAD File BOISDOL2.ANL Output for Member No. 40, Axial Load in the Local X-axis.

Brace Axial Load Component Forces:

Dead Load Axial Force: $Q_{Dp40} := 3.9$ kips

Live Load Axial Force: $Q_{Lp40} := 0.0$ kips

Snow Load Axial Force: $Q_{Sp40} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep40} := 150.0$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p40} := 1.1\cdot\left(Q_{Dp40} + Q_{Lp40} + Q_{Sp40}\right)$

$Q_{G46p40} = 4.3$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p40} := 0.9\cdot Q_{Dp40}$

$Q_{G47p40} = 3.5$ kips

Action Due to Combined Gravity Plus Earthquake Forces; FEMA 310, (Eq. 4-8) $Q_{UD} = Q_G$ +/- Q_E:

$$Q_{UDp40} := \mathrm{if}\left(Q_{G46p40} \geq Q_{G47p40}, Q_{G46p40} + Q_{Ep40}, Q_{G47p40} + Q_{Ep40}\right)$$

$Q_{UDp40} = 154.3$ kips **<---- Brace compression axial load deformation-controlled design action**

Building Section 2 - Longitudinal Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis - Second Story Brace (Continued)

Acceptance Criteria:

Axial Demand: $Q_{UDp40} = 154.3$ kips

Expected Axial Capacity: $Q_{CE5STD} = 99.6$ kips

Determine Component Modification Factor for Diagonal Braces
(FEMA 310, Section 3.5.3.4, Page 4-16, Table 4-3):

For circular section in compression:

$$m_{5STD} := \text{if}\left(\frac{d_{5STD}}{t_{5STD}} \le \frac{1500}{F_{yebrace}}, 6.0, \text{if}\left(\frac{d_{5STD}}{t_{5STD}} > \frac{6000}{F_{yebrace}}, 3.0, \text{"Interpolate"}\right)\right) \qquad m_{5STD} = 6.0$$

FEMA 310, Eq. (4-12):

$$\frac{Q_{UDp40}}{m_{5STD}} = 25.7$$

$$\text{if}\left(Q_{CE5STD} \ge \frac{Q_{UDp40}}{m_{5STD}}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand to Capacity Ratio for Second Floor Longitudinal Brace in Building Section 2:

$$DCR_{p40} := \frac{\left(\frac{Q_{UDp40}}{m_{5STD}}\right)}{Q_{CE5STD}} \qquad DCR_{p40} = 0.26$$

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Determine Component Strength -- First Story Column:

FEMA 310, Section 4.2.4.4, Component Strength:

Per FEMA 310, Section 4.2.4.3, Columns are Force Controlled elements for Axial Loads. Determine the Design Axial Strength per LRFD, 2nd Ed., Sections E1 & E2. Design by plastic analysis is permitted if the column slenderness parameter λ_c does not exceed 1.5K. The design strength for flexural buckling of compression members whose elements have width-thickness ratios less than λ_r from Section B5.1 is ϕPn. The factor ϕ_c = 0.85, but per FEMA 310, Section 4.2.4.4, Commentary, ϕ = 1

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Length of Column: Set equal to story height. $L_{col1} := h_1$ $L_{col1} = 13.83$ ft.

Effective Length Factor of Brace: (pin-pin) $K := 1.0$

For 8" STD Pipe (8" X 0.322"):

Area of pipe: $A_{8STD} := 8.40$ sq.in.

Outside diameter of pipe: $d_{8STD} := 8.625$ in.

Thickness of pipe: $t_{8STD} := 0.322$ in.

Diameter to thickness ratio: $\frac{d_{8STD}}{t_{8STD}} = 26.8$

Radius of gyration: $r_{8STD} := 1.88$ in.

Yield strength of steel for columns F_y=36 ksi, (See Appendix A, Figure No. 14): $F_{ycol} := 36.0$ ksi

Diameter to thickness ratio of pipe: Must be less than λ_r as given in LRFD Table B5.1 in order for E2 to apply. $\frac{d_{8STD}}{t_{8STD}} = 26.8$ $\frac{3300}{F_{ycol}} = 91.7$

$\text{Result} := \text{if}\left(\frac{d_{8STD}}{t_{8STD}} < \frac{3300}{F_{ybrace}}, \text{"OK, E2 is Applicable"}, \text{" E2 is Not Applicable"}\right)$ Result = "OK, E2 is Applicable"

Building Section 2 - Longitudinal Braced Frame (Continued):

Determine Component Strength -- First Story Column (Continued)

LRFD, Section E2: $\lambda_c := \frac{K \cdot L_{col1} \cdot 12}{r_{8STD} \cdot \pi} \cdot \sqrt{\frac{F_{ycol}}{29000}}$ $\lambda_c = 0.99$

$F_{cr8STD} := \mathrm{if}\left[\lambda_c \le 1.5, \left(0.658^{\lambda_c^{2}}\right) \cdot F_{ycol}, \left(\frac{0.877}{\lambda_c^{2}}\right) \cdot F_{ycol}\right]$ $F_{cr8STD} = 23.9$ ksi

Nominal Strength:

$P_n = A_g F_{cr}$ $P_{n8STD} := F_{cr8STD} \cdot A_{8STD}$ $P_{n8STD} = 200.6$ kips

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9,
The expected strength is equal to 1.25 x Nominal Strength:

$Q_{CE8STD} := 1.25 \cdot P_{n8STD}$ $Q_{CE8STD} = 250.8$ kips

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Determine Component Strength -- First Story Column

See STAAD File BOISDOL2.ANL Output for Member No. 8, Axial Load in Local X-axis.

Axial Dead Load: $Q_{Dp8} := 22.8$ kips

Axial Live Load: $Q_{Lp8} := 3.3$ kips

Axial Snow Load: $Q_{Sp8} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep8} := 113.6$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p8} := 1.1 \cdot \left(Q_{Dp8} + Q_{Lp8} + Q_{Sp8}\right)$ $Q_{G46p8} = 28.7$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p8} := 0.9 \cdot Q_{Dp8}$ $Q_{G47p8} = 20.5$ kips

Action Due to Gravity Forces; Maximum of FEMA 310, (Eq. 4-6) or (Eq. 4-7):

$Q_{Gp8} := \mathrm{if}\left(Q_{G46p8} \geq Q_{G47p8}, Q_{G46p8}, Q_{G47p8}\right)$ $Q_{Gp8} = 28.7$ kips

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Axial Stress Analysis -- First Story Column:

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Method 1

Force-controlled action, Q_{UF} shall be calculated as the sum of forces due to gravity and the maximum force that can be delivered by deformation-controlled actions.

Method 2

Alternatively, force-controlled action may be calculated according to Equations (4-9) or Equation (4-10). Equation (4-9) shall be used when the forces contributing to Q_{UF} are delivered by yielding of the seismic framing system. Equation (4-10) shall be used for all other evaluations.

FEMA 310; Equation 4-9 $Q_{UF49} := Q_G + \frac{Q_E}{C \cdot J}$

Action due to gravity loads and earthquake forces.

FEMA 310; Equation 4-10. $Q_{UF410} := Q_G + \frac{Q_E}{C}$

Modification Factor defined in Table 3-4 on page 3-8. $C := 1.2$

Equation 4-11 A force reduction factor not to exceed 2.5 for Life Safety or 2.0 for Immediate Occupancy.

$J := \mathrm{if}\left(1.5 + S_{DS} \le 2.5, 1.5 + S_{DS}, 2.5\right)$ $J = 1.86$ **<--- LOP = LS**

FEMA 310; Eq. (4-9): $Q_{UF49p8} := Q_{Gp8} + \frac{Q_{Ep8}}{C \cdot J}$ $Q_{UF49p8} = 79.6$ kips

FEMA 310; Eq.(4-10): $Q_{UF410p8} := Q_{Gp8} + \frac{Q_{Ep8}}{C}$ $Q_{UF410p8} = 123.4$ kips

The force-controlled action in the column is delivered by yeilding (deformation) of the brace; therefore, Equation 4-9 controls.

$Q_{UFp8} := Q_{UF49p8}$ $Q_{UFp8} = 79.6$ kips **<---- Column compression axial load force-controlled design action**

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Axial Stress Analysis -- First Story Column (Continued):

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Acceptance Criteria:

Axial Demand: $Q_{UFp8} = 79.6$ kips

Expected Axial Capacity: $Q_{CE8STD} = 250.8$ kips

FEMA 310, Eq. (4-13):

$$\text{if}\left(Q_{CE8STD} \ge Q_{UFp8}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand-to-Capacity Ratio for Axial Load on Lower Section of Column $DCR_{p8} := \dfrac{Q_{UFp8}}{Q_{CE8STD}}$ $DCR_{p8} = 0.32$

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Typical Brace Connection Analysis:

Verify a typical connection between brace and column. Use connection at first story which is more heavily loaded. Typical details are shown on design drawings (See Appendix A, Figure 21, Detail 1/S8 and 3/S8 and Figure 23, Detail 20/S10 and 21/S10. There is a minimum of 30 inches (based on scaled dimensions) of 1/4-inch fillet weld between the brace pipe and the connection plate and a similar length of weld between the connection plate and beam or column. Assume that a E60 (60,000 psi) weld metal was used. Per FEMA 310, Section 4.2.4.3, connections are Force-Controlled Action elements.

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Diagonal Brace Loads Analysis - First Story Brace

See STAAD File BOISDOL2.ANL Output for Member No. 36, Axial Load in Local X-axis.

Dead Load Axial Force: $Q_{Dp36} = 7.9$ kips

Live Load Axial Force: $Q_{Lp36} = 2.0$ kips

Snow Load Axial Force: $Q_{Sp36} = 0$ kips

Action Due to Earthquake Forces: $Q_{Ep36} = 283.0$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p36} := 1.1 \cdot (Q_{Dp36} + Q_{Lp36} + Q_{Sp36})$ $Q_{G46p36} = 10.9$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p36} := 0.9 \cdot Q_{Dp36}$ $Q_{G47p36} = 7.1$ kips

Action Due to Gravity Forces; Maximum of FEMA 310, (Eq. 4-6) or (Eq. 4-7):

$Q_{Gp36} := \mathrm{if}(Q_{G46p36} \geq Q_{G47p36}, Q_{G46p36}, Q_{G47p36})$ $Q_{Gp36} = 10.9$ kips

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Typical Brace Connection Analysis (Continued):

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Method 1
Force-controlled action, Q_{UF} shall be calculated as the sum of forces due to gravity and the maximum force that can be delivered by deformation-controlled actions.

Method 2
Alternatively, force-controlled action may be calculated according to Equations (4-9) or Equation (4-10). Equation (4-9) shall be used when the forces contributing to Q_{UF} are delivered by yielding of the seismic framing system. Equation (4-10) shall be used for all other evaluations.

FEMA 310; Equation 4-9 $\quad Q_{UF49} := Q_G + \frac{Q_E}{C \cdot J}$

Action due to gravity loads and earthquake forces.

FEMA 310; Equation 4-10. $\quad Q_{UF410} := Q_G + \frac{Q_E}{C}$

Modification Factor defined in Table 3-4 on page 3-8. $\quad C := 1.2$

Equation 4-11 A force reduction factor not to exceed 2.5 for Life Safety or 2.0 for Immediate Occupancy.

$J := \mathrm{if}\left(1.5 + S_{DS} \le 2.5, 1.5 + S_{DS}, 2.5\right) \quad J = 1.86$ **<--- LOP = LS**

FEMA 310; Eq. (4-9): $\quad Q_{UF49p36} := Q_{Gp36} + \frac{Q_{Ep36}}{C \cdot J} \quad Q_{UF49p36} = 137.7$ kips

$Q_{UF410p36} := Q_{Gp36} + \frac{Q_{Ep36}}{C} \quad Q_{UF410p36} = 246.7$ kips

The force-controlled action in the brace connections is delivered by yeilding (deformation) of the brace; therefore, Equation 4-9 controls.

$Q_{UFp36} := Q_{UF49p36} \quad Q_{UFp36} = 137.7$ kips

Building Section 2 - Longitudinal Braced Frame Analysis (Continued):

Determine Component Strength of Welded Connection:

Per FEMA 310, Section 4.2.4.3, Connections are Force Controlled elements. Determine the design shear strength of the fillet weld per LRFD, 2nd Ed., Section J2, Table J2.5. Assume E60 electrode. The factor $\phi_c = 0.75$, but per FEMA 310, Section 4.2.4.4, Commentary, $\phi = 1$.

Determine Ultimate Capacity on Effective Throat of Fillet Weld per AISC "Load & Resistance Factor Design", Table J2.5:

Strength of weld material: $F_{e60} := 60.0$ ksi

Throat of weld: $w_{throat} := .25$ in.

Effective throat of weld: $w_{eff} := 0.707 \cdot w_{throat}$ $w_{eff} = 0.177$ in.

Length of weld: $l_{weld} := 30$ in.

Ultimate Capacity of Weld: (Nominal strength) $P_{nweld} := w_{eff} \cdot l_{weld} \cdot \left(0.60 \cdot F_{e60}\right)$ $P_{nweld} = 190.89$ kips

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9, The expected strength is equal to 1.25 x Nominal Strength:

$Q_{CEweld} := 1.25 \cdot P_{nweld}$ $Q_{CEweld} = 238.6$ kips

Acceptance Criteria:

Axial Demand: $Q_{UFp36} = 137.7$ kips

Expected Axial Capacity: $Q_{CEweld} = 238.6$ kips

FEMA 310, Eq. (4-13):

$$\mathrm{if}\left(Q_{CEweld} \ge Q_{UFp36}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand-to-Capacity Ratio for Welds Between Brace and Column or Beam: $DCR_{weld} := \dfrac{Q_{UFp36}}{Q_{CEweld}}$ $DCR_{weld} = 0.577$

Welds at other brace connections are similar in length and size and these connections are not reviewed.

Building Section 2 - Transverse Braced Frame:

Diagonal Brace Compression Stress Analysis - First Story Brace

See STAAD File BOISDOT2.ANL Output for Member No. 70, Axial Load Local X-axis.

Dead Load Axial Force: $Q_{Dp70} := 6.0$ kips

Live Load Axial Force: $Q_{Lp70} := 1.2$ kips

Snow Load Axial Force: $Q_{Sp70} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep70} := 367.6$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p70} := 1.1 \cdot \left(Q_{Dp70} + Q_{Lp70} + Q_{Sp70}\right)$ $Q_{G46p70} = 7.9$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p70} := 0.9 \cdot Q_{Dp70}$ $Q_{G47p70} = 5.4$ kips

Action Due to Combined Gravity Plus
Earthquake Forces; FEMA 310, (Eq. 4-8):

$$Q_{UDp70} := \mathrm{if}\left(Q_{G46p70} \geq Q_{G47p70}, Q_{G46p70} + Q_{Ep70}, Q_{G47p70} + Q_{Ep70}\right)$$

$Q_{UDp70} = 375.5$ kips **<---- Brace compression axial load deformation-controlled design action**

Building Section 2 - Transverse Braced Frame (Continued):

Determine Component Strength -- First Story Brace

The first story brace for the transverse frame is the same as the first story brace for the longitudinal braced frame (6" STD Pipe). Use component strength from above.

Diagonal Brace Compression Stress Analysis - First Floor Brace (Continued)

Acceptance Criteria:

Axial Demand: $Q_{UDp70} = 375.5$ kips

Expected Axial Capacity: $Q_{CE6STD} = 152$ kips

Modification Factor for Diagonal Braces (6" STD Pipe): $m_{6STD} = 6.0$

FEMA 310, Eq. (4-12):

$$\frac{Q_{UDp70}}{m_{6STD}} = 62.587$$

$$\text{if}\left(Q_{CE6STD} \geq \frac{Q_{UDp70}}{m_{6STD}}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand to Capacity Ratio for Transverse Brace in Building Section 2:

$$DCR_{p70} := \frac{\left(\frac{Q_{UDp70}}{m_{6STD}}\right)}{Q_{CE6STD}} \qquad DCR_{p70} = 0.41$$

Building Section 2 - Transverse Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis - Second Story Brace

See STAAD File BOISEDOT2.ANL Output for Member No. 72, Axial Load in the Local X-axis.

Dead Load Axial Force: $Q_{Dp72} := -5.7$ kips

Live Load Axial Force: $Q_{Lp72} := -1.9$ kips

Snow Load Axial Force: $Q_{Sp72} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep72} := 179.1$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p72} := 1.1 \cdot \left(Q_{Dp72} + Q_{Lp72} + Q_{Sp72}\right)$ $Q_{G46p72} = -8.4$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p72} := 0.9 \cdot Q_{Dp72}$ $Q_{G47p72} = -5.1$ kips

Action Due to Combined Gravity Plus
Earthquake Forces; FEMA 310, (Eq. 4-8):

$$Q_{UDp72} := \mathrm{if}\left(Q_{G46p72} \ge Q_{G47p72}, Q_{G46p72} + Q_{Ep72}, Q_{G47p72} + Q_{Ep72}\right)$$

$Q_{UDp72} = 174.0$ kips **<---- Brace compression axial load deformation-controlled design action**

Building Section 2 - Transverse Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis - Second Story Brace (Continued)

Determine Component Strength of Second Story Brace

The second story brace for the transverse frame is the same as the second story brace for the longitudinal braced frame (5" STD Pipe). Use component strength from above.

Acceptance Criteria:

Axial Demand: $Q_{UDp72} = 174.0$ kips

Expected Axial Capacity: $Q_{CE5STD} = 99.6$ kips

Component Modification Factor for Diagonal Braces (5" STD Pipe) $m_{5STD} = 6.0$

FEMA 310, Eq. (4-12):

$$\frac{Q_{UDp72}}{m_{5STD}} = 28.995$$

$$\text{if}\left(Q_{CE5STD} \geq \frac{Q_{UDp72}}{m_{5STD}}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand to Capacity Ratio for First Story Transverse Brace in Building Section 2:

$$DCR_{p72} := \frac{\left(\frac{Q_{UDp72}}{m_{5STD}}\right)}{Q_{CE5STD}} \qquad DCR_{p72} = 0.29$$

Building Section 2 - Transverse Braced Frame (Continued):

Determine Component Strength of First Story Column

Per FEMA 310, Section 4.2.4.3, Columns are Force Controlled elements for Axial Loads. Design by plastic analysis is permitted if the column slenderness parameter λ_c does not exceed 1.5K. The design strength for flexural buckling of compression members whose elements have width-thickness ratios less than λ_r from Section B5.1 is ϕPn. The factor $\phi_c = 0.85$, but per FEMA 310, Section 4.2.4.4, Commentary, $\phi = 1$

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Length of Column:
Set equal to story height. $L_{coll} := h_1$ $L_{coll} = 13.83$ ft.

Effective Length Factor of Brace:
(pin-pin) $K := 1.0$

For 8" XXS Pipe (8" X 0.875"):

Area of pipe: $A_{8XXS} := 21.3$ sq.in.

Outside diameter of pipe: $d_{8XXS} := 8.625$ in.

Thickness of pipe: $t_{8XXS} := 0.875$ in.

Diameter to thickness ratio: $\frac{d_{8XXS}}{t_{8XXS}} = 9.9$

Radius of gyration: $r_{8XXS} := 2.76$ in.

Yield strength of steel for columns F_y=36 ksi,
(See Appendix A, Figure No. 14): $F_{ycol} = 36$ ksi

Diameter to thickness ratio of pipe:
Must be less than λ_r as given in LRFD
Table B5.1 in order for E2 to apply. $\frac{d_{8XXS}}{t_{8XXS}} = 9.9$ $\frac{3300}{F_{ycol}} = 91.7$

Result := if$\left(\frac{d_{8XXS}}{t_{8XXS}} < \frac{3300}{F_{ybrace}}\right.$, "OK, E2 is Applicable" , " E2 is Not Applicable"$\left.\right)$ Result = "OK, E2 is Applicable"

Building Section 2 - Longitudinal Braced Frame (Continued):

Determine Component Strength -- First Story Column (Continued):

LRFD, Section E2:

$$\lambda_c := \frac{K \cdot L_{col1} \cdot 12}{r_{8XXS} \cdot \pi} \cdot \sqrt{\frac{F_{ycol}}{29000}} \qquad \lambda_c = 0.674$$

$$F_{cr8XXS} := \mathrm{if}\left[\lambda_c \le 1.5, \left(0.658^{\lambda_c^{\,2}}\right) \cdot F_{ycol}, \left(\frac{0.877}{\lambda_c^{\,2}}\right) \cdot F_{ycol}\right] \qquad F_{cr8XXS} = 29.8 \quad \text{ksi}$$

Nominal Strength:

$$P_n = A_g F_{cr} \qquad P_{n8XXS} := F_{cr8XXS} \cdot A_{8XXS} \qquad P_{n8XXS} = 633.9 \quad \text{kips}$$

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9,
The expected strength is equal to 1.25 x Nominal Strength:

$$Q_{CE8XXS} := 1.25 \cdot P_{n8XXS} \qquad Q_{CE8XXS} = 792.4 \quad \text{kips}$$

Building Section 2 - Transverse Braced Frame Analysis (Continued):

Axial Stress Analysis -- First Story Column:

Per FEMA 310, Sec. 4.2.4.3, pg. 4-6, this is a Force Controlled element. Analysis is based on Linear Static Procedures. Axial loads are obtained from STAAD File BOISEDOT2.ANL.

STAAD Output for Member No. 65.

Axial Dead Load: $Q_{Dp65} := 67.0$ kips

Axial Live Load: $Q_{Lp65} := 13.9$ kips

Axial Snow Load: $Q_{Sp65} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep65} := 371.7$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p65} := 1.1 \cdot \left(Q_{Dp65} + Q_{Lp65} + Q_{Sp65}\right)$

$Q_{G46p65} = 89.0$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p65} := 0.9 \cdot Q_{Dp65}$

$Q_{G47p65} = 60.3$ kips

Action Due to Gravity Forces; Maximum of FEMA 310, (Eq. 4-6) or (Eq. 4-7):

$$Q_{Gp65} := \mathrm{if}\left(Q_{G46p65} \geq Q_{G47p65}, Q_{G46p65}, Q_{G47p65}\right)$$

$Q_{Gp65} = 89.0$ kips **<---- Column compression axial load force-controlled design action**

Building Section 2 - Transverse Braced Frame Analysis (Continued):

Axial Stress Analysis -- First Story Column (Continued):

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Method 1
Force-controlled action, Q_{UF} shall be calculated as the sum of forces due to gravity and the maximum force that can be delivered by deformation-controlled actions.

Method 2
Alternatively, force-controlled action may be calculated according to Equations (4-9) or Equation (4-10). Equation (4-9) shall be used when the forces contributing to Q_{UF} are delivered by yielding of the seismic framing system. Equation (4-10) shall be used for all other evaluations.

FEMA 310; Equation 4-9 $Q_{UF49} := Q_G + \frac{Q_E}{C \cdot J}$

Action due to gravity loads and earthquake forces.

FEMA 310; Equation 4-10. $Q_{UF410} := Q_G + \frac{Q_E}{C}$

Modification Factor defined in Table 3-4 on page 3-8. $C = 1.2$

Equation 4-11 A force reduction factor not to exceed 2.5 for Life Safety or 2.0 for Immediate Occupancy.

$J := \mathrm{if}(1.5 + S_{DS} \le 2.5, 1.5 + S_{DS}, 2.5)$ $J = 1.86$ **<--- LOP = LS**

FEMA 310; Eq. (4-9): $Q_{UF49p65} := Q_{Gp65} + \frac{Q_{Ep65}}{C \cdot J}$ $Q_{UF49p65} = 255.6$ kips

FEMA 310; Eq.(4-10): $Q_{UF410p65} := Q_{Gp65} + \frac{Q_{Ep65}}{C}$ $Q_{UF410p65} = 398.7$ kips

The force-controlled action in the column is delivered by yeilding (deformation) of the brace; therefore, Equation 4-9 controls.

$Q_{UFp65} := Q_{UF49p65}$ $Q_{UFp65} = 255.6$ kips

Building Section 2 - Transverse Braced Frame Analysis (Continued):

Axial Stress Analysis -- First Story Column (Continued):

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Acceptance Criteria:

Axial Demand: $Q_{UFp65} = 255.6$ kips

Expected Axial Capacity: $Q_{CE8XXS} = 792.4$ kips

FEMA 310, Eq. (4-13):

$$\mathrm{if}\left(Q_{CE8XXS} \geq Q_{UFp65}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand-to-Capacity Ratio for Axial Load on Lower Section of Column $DCR_{p65} := \frac{Q_{UFp65}}{Q_{CE8XXS}}$ $DCR_{p65} = 0.32$

Building Section 2 - Longitudinal and Transverse Braced Frame Analysis:

Under Tier 1 Evaluation, the second story bracing members did not meet the Weak Story requirements that the bracing at a given story shall not be less than 80% of the strength in an adjacent story. The Tier 2 Evaluation requires that the lateral-force-resisting system in the non-compliant story be checked for the capacity to resist one half of the total psuedo lateral force.

Vertical distribution factor for the roof diaphragm in the longitudinal direction: $C_{2v2long} = 0.525$ **> 0.5**

Vertical distribution factor for the roof diaphragm in the transverse direction: $C_{2v2trans} = 0.525$ **> 0.5**

Since it has already been shown that the lateral-force-resisting system for the second story is capable of taking the higher lateral force associated with a $C_v = 0.525$, no further analysis of the second story bracing system is required.

Building Section 1 - Longitudinal Braced Frame:

Determine Component Strength of Brace

Per FEMA 310, Section 4.2.4.3, Braces are Deformation Controlled elements. Determine the Design Axial Strength per LRFD, 2nd Ed., Sections E1 & E2. Braces will experience tension or compression loads. Determine component strength based on compression condition which is more critical due to effective length. Design by plastic analysis is permitted if the column slenderness parameter λ_c does not exceed 1.5K. The design strength for flexural buckling of compression members whose elements have width-thickness ratios less than λ_r from Section B5.1 is ϕPn. The factor $\phi_c = 0.85$, but per FEMA 310, Section 4.2.4.4, Commentary, $\phi = 1$

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Yield strength of steel for braces F_y=36 ksi, (See Appendix A, Figure No. 14): $F_{ybrace} := 36.0$ ksi

Average Span Length of Braced Spans: Equals 1/2 of typical bay length $s_{br} := \frac{L_{bay}}{2}$ $s_{br} = 12$ ft.

Height of Brace: Equals the Story Height $h_{br} := h_1$ $h_{br} = 13.83$ ft.

Length of Brace: $L_{br} := \sqrt{s_{br}^2 + h_{br}^2}$ $L_{br} = 18.31$ ft.

Effective Length Factor of Brace $K := 1.0$

For 4" STD Pipe (6" X 0.237"):

Area of pipe: $A_{4STD} := 3.17$ sq.in.

Outside diameter of pipe: $d_{4STD} := 4.5$ in.

Thickness of pipe: $t_{4STD} := 0.237$ in.

Diameter to thickness ratio: $\frac{d_{4STD}}{t_{4STD}} = 19$

Radius of gyration: $r_{4STD} := 1.51$ in.

Diameter to thickness ratio of pipe: Must be less than λ_r as given in LRFD Table B5.1 in order for E2 to apply. $\frac{d_{4STD}}{t_{4STD}} = 19$ $\frac{3300}{F_{ycol}} = 91.7$

$$\text{Result} := \text{if}\left(\frac{d_{4STD}}{t_{4STD}} < \frac{3300}{F_{ybrace}}, \text{"OK, E2 is Applicable"}, \text{" E2 is Not Applicable"}\right)$$

Result = "OK, E2 is Applicable"

Building Section 1 - Longitudinal Braced Frame (Continued):

Determine Component Strength of Brace (Continued):

LRFD, Section E2: $\lambda_c := \frac{K \cdot L_{br} \cdot 12}{r_{4STD} \cdot \pi} \cdot \sqrt{\frac{F_{ybrace}}{29000}}$ $\lambda_c = 1.632$

$F_{cr4STD} := \mathrm{if}\left(\lambda_c \le 1.5, 0.658^{\lambda_c^2} \cdot F_{ybrace}, \frac{0.877}{\lambda_c^2} \cdot F_{ybrace}\right)$ $F_{cr4STD} = 11.855$ ksi

Nominal Strength:

$P_n = A_g F_{cr}$ $P_{n4STD} := F_{cr4STD} \cdot A_{4STD}$ $P_{n4STD} = 37.6$ kips

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9,
The expected strength is equal to 1.25 x Nominal Strength:

$Q_{CE4STD} := 1.25 \cdot P_{n4STD}$ $Q_{CE4STD} = 47$ kips

Building Section 1 - Longitudinal Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis of Brace

See STAAD File BOISEDOL1.ANL for Member No. 58, Axial Load in Local X-axis.

Dead Load Axial Force: $Q_{Dp58} := 3.9$ kips

Live Load Axial Force: $Q_{Lp58} := 0.0$ kips

Snow Load Axial Force: $Q_{Sp58} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep58} := 40.0$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p58} := 1.1\cdot\left(Q_{Dp58} + Q_{Lp58} + Q_{Sp58}\right)$ $Q_{G46p58} = 4.3$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p58} := 0.9\cdot Q_{Dp58}$ $Q_{G47p58} = 3.5$ kips

Action Due to Combined Gravity Plus
Earthquake Forces; FEMA 310, (Eq. 4-8):

$$Q_{UDp58} := \mathrm{if}\left(Q_{G46p58} \geq Q_{G47p58}, Q_{G46p58} + Q_{Ep58}, Q_{G47p58} + Q_{Ep58}\right)$$

$Q_{UDp58} = 44.3$ kips **<---- Brace compression axial load deformation-controlled design action**

Building Section 1 - Longitudinal Braced Frame (Continued):

Diagonal Brace Compression Stress Analysis of Brace (Continued):

Acceptance Criteria:

Axial Demand: $Q_{UDp58} = 44.3$ kips

Expected Axial Capacity: $Q_{CE4STD} = 47$ kips

Determine Component Modification Factor for Diagonal Braces
(FEMA 310, Section 3.5.3.4, Page 4-16, Table 4-3):

Expected strength of braces is equal to 1.25 X Fybrace
(FEMA 310, Section 4.2.4.4, page 4-8)

$F_{yebrace} := 1.25 \cdot F_{ybrace}$

$F_{yebrace} = 45.0$ ksi.

For circular section in compression:

$$\frac{d_{4STD}}{t_{4STD}} = 19$$

$$m_{4STD} := \text{if}\left(\frac{d_{4STD}}{t_{4STD}} \le \frac{1500}{F_{yebrace}}, 6.0, \text{if}\left(\frac{d_{4STD}}{t_{4STD}} > \frac{6000}{F_{yebrace}}, 3.0, \text{"Interpolate"}\right)\right) \qquad m_{4STD} = 6.0$$

FEMA 310, Eq. (4-12):

$$\text{if}\left(Q_{CE4STD} \ge \frac{Q_{UDp58}}{m_{4STD}}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand to Capacity Ratio for Longitudinal Brace in Building Section 1:

$$DCR_{p58} := \frac{\left(\frac{Q_{UDp58}}{m_{4STD}}\right)}{Q_{CE4STD}} \qquad DCR_{p58} = 0.16$$

Building Section 1 - Longitudinal Braced Frame Analysis (Continued):

Column Axial Stress Analysis:

Per FEMA 310, Sec. 4.2.4.3, pg. 4-6, this is a Force Controlled element. Analysis is based on Linear Static Procedures. Axial loads are obtained from STAAD File BOISEDOL1.ANL.

Axial loads are obtained from STAAD File BOISEDOL1.ANL for Member No. 52 for axial loads in the Local X-axis

Axial Dead Load: $Q_{Dp52} := 6.7$ kips

Axial Live Load: $Q_{Lp52} := 0.0$ kips

Axial Snow Load: $Q_{Sp52} := 0.0$ kips

Action Due to Earthquake Forces: $Q_{Ep52} := 0.0$ kips

Determine Component Gravity Loads (FEMA 310 4.2.4.2 pg 4-6):

Action Due to Gravity Forces:

FEMA 310, (Eq. 4-6): $Q_{G46p52} := 1.1 \cdot \left(Q_{Dp52} + Q_{Lp52} + Q_{Sp52}\right)$ $Q_{G46p52} = 7.4$ kips

FEMA 310, (Eq. 4-7): $Q_{G47p52} := 0.9 \cdot Q_{Dp52}$ $Q_{G47p52} = 6$ kips

Action Due to Gravity Forces; Maximum of FEMA 310, (Eq. 4-6) or (Eq. 4-7):

$$Q_{Gp52} := \text{if}\left(Q_{G46p52} \geq Q_{G47p52}, Q_{G46p52}, Q_{G47p52}\right)$$

$Q_{Gp52} = 7.4$ kips **<---- Column compression axial load force-controlled design action**

Building Section 1 - Longitudinal Braced Frame Analysis (Continued):

Column Axial Stress Analysis (Continued):

Determine Component Strength of Column:

Per FEMA 310, Section 4.2.4.3, Columns are Force Controlled elements for Axial Loads. Design by plastic analysis is permitted if the column slenderness parameter λ_c does not exceed 1.5K. The design strength for flexural buckling of compression members whose elements have width-thickness ratios less than λ_r from Section B5.1 is ϕPn. The factor $\phi_c = 0.85$, but per FEMA 310, Section 4.2.4.4, Commentary, $\phi = 1$

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Determine Ultimate Capacity of Brace in Compression per AISC "Load & Resistance Factor Design", Chapter E:

Length of Column:
Set equal to story height. $L_{coll} := h_1$ $L_{coll} = 13.83$ ft.

Effective Length Factor of Brace:
(pin-pin) $K := 1.0$

For 5" STD Pipe (5" X 0.258"):

Area of pipe:	$A_{5STD} = 4.3$	sq.in.
Outside diameter of pipe:	$d_{5STD} = 5.563$	in.
Thickness of pipe:	$t_{5STD} = 0.258$	in.
Diameter to thickness ratio:	$\frac{d_{5STD}}{t_{5STD}} = 21.6$	
Radius of gyration:	$r_{5STD} = 1.88$	in.
Yield strength of steel for columns F_y=36 ksi, (See Appendix A, Figure No. 14):	$F_{ycol} = 36.0$	ksi

Diameter to thickness ratio of pipe:
Must be less than λ_r as given in LRFD
Table B5.1 in order for E2 to apply. $\frac{d_{5STD}}{t_{5STD}} = 21.6$ $\frac{3300}{F_{ycol}} = 91.7$

$$\text{Result} := \text{if}\left(\frac{d_{5STD}}{t_{5STD}} < \frac{3300}{F_{ybrace}}, \text{"OK, E2 is Applicable"}, \text{" E2 is Not Applicable"}\right)$$ Result = "OK, E2 is Applicable"

Building Section 1 - Longitudinal Braced Frame (Continued):

Determine Component Strength of Column:

LRFD, Section E2:

$$\lambda_c := \frac{K \cdot L_{col1} \cdot 12}{r_{5STD} \cdot \pi} \cdot \sqrt{\frac{F_{ycol}}{29000}} \qquad \lambda_c = 0.99$$

$$F_{cr5STD} := \text{if}\left[\lambda_c \le 1.5, \left(0.658^{\lambda_c^2}\right) \cdot F_{ycol}, \left(\frac{0.877}{\lambda_c^2}\right) \cdot F_{ycol}\right] \qquad F_{cr5STD} = 23.9 \text{ ksi}$$

Nominal Strength:

$P_n = A_g F_{cr}$

$$P_{n5STD} := F_{cr5STD} \cdot A_{5STD} \qquad P_{n5STD} = 102.7 \text{ kips}$$

Expected Axial Strength (FEMA 310, Sec. 4.2.4.4 and 4.2.4.5, Pg. 4-8 and 4-9,
The expected strength is equal to 1.25 x Nominal Strength:

$$Q_{CE5STD} := 1.25 \cdot P_{n5STD} \qquad Q_{CE5STD} = 128.4 \text{ kips}$$

Building Section 1 - Longitudinal Braced Frame Analysis (Continued):

Column Axial Stress Analysis (Continued):

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Method 1
Force-controlled action, Q_{UF} shall be calculated as the sum of forces due to gravity and the maximum force that can be delivered by deformation-controlled actions.

Method 2
Alternatively, force-controlled action may be calculated according to Equations (4-9) or Equation (4-10). Equation (4-9) shall be used when the forces contributing to Q_{UF} are delivered by yielding of the seismic framing system. Equation (4-10) shall be used for all other evaluations.

FEMA 310; Equation 4-9 $Q_{UF49} := Q_G + \frac{Q_E}{C \cdot J}$

Action due to gravity loads and earthquake forces.

FEMA 310; Equation 4-10. $Q_{UF410} := Q_G + \frac{Q_E}{C}$

Modification Factor defined in Table 3-4 on page 3-8. $C := 1.2$

Equation 4-11 A force reduction factor not to exceed 2.5 for Life Safety or 2.0 for Immediate Occupancy.

$J := \text{if}\left(1.5 + S_{DS} \le 2.5, 1.5 + S_{DS}, 2.5\right)$ $J = 1.86$ **<--- LOP = LS**

FEMA 310; Eq. (4-9): $Q_{UF49p52} := Q_{Gp52} + \frac{Q_{Ep52}}{C \cdot J}$ $Q_{UF49p52} = 7.4$ kips

FEMA 310; Eq.(4-10): $Q_{UF410p52} := Q_{Gp52} + \frac{Q_{Ep52}}{C}$ $Q_{UF410p52} = 7.4$ kips

The force-controlled action in the column is delivered by yeilding (deformation) of the brace; therefore, Equation 4-9 controls.

$Q_{UFp52} := Q_{UF49p52}$ $Q_{UFp52} = 7.4$ kips

Building Section 1 - Longitudinal Braced Frame Analysis (Continued):

Column Axial Stress Analysis (Continued):

Force-Controlled Action (FEMA 310, Section 4.2.4.3.2, page 4-7):

Acceptance Criteria:

Axial Demand: $Q_{UFp52} = 7.4$ kips

Expected Axial Capacity: $Q_{CE5STD} = 128.4$ kips

FEMA 310, Eq. (4-13):

$$\text{if}\left(Q_{CE5STD} \ge Q_{UFp52}, \text{"COMPLIANT"}, \text{"NONCOMPLIANT"}\right) = \text{"COMPLIANT"}$$

Demand-to-Capacity Ratio for Axial Load on Lower Section of Column $DCR_{P52} := \frac{Q_{UFp52}}{Q_{CE5STD}}$ $DCR_{P52} = 0.06$

Building Section 1 - Transverse Braced Frame Analysis:

The transverse braced frame in Building Section 1 is the same configuration and member sizes as the longitudinal frame in Building Section 1. The dead load and live load forces are less on the transverse frame than on the longitudinal frame due to a smaller tributary area. The earthquake induced forces are the same in the longitudinal and transverse directions because the number of lateral-force-reisiting elements is the same. The transverse braced frame is satisfactory by inspection and no analysis is performed.

Appendix E -- Evaluation Phase Calculations (Tier 2)

(STAAD Planar Frame File: BOISDOL2.ANL)

```
     ****************************************************
     *                                                  *
     *              S T A A D - III                     *
     *              Revision 22.3a                      *
     *              Proprietary Program of              *
     *              Research Engineers, Inc.            *
     *              Date=    SEP 20, 1999               *
     *              Time=    13:16:12                   *
     *              Build No.    2415                   *
     *         USER ID: Bureau of Reclamation           *
     ****************************************************

  1. STAAD PLANE FILE BOISDOL2.STD
  2. INPUT WIDTH 72
  3. UNIT FEET KIP
  4. JOINT COORDINATES
  5.      1         .000        14.000         .000
  6.      2       24.000        14.000         .000
  7.      4         .000          .000         .000
  8.      5         .000        28.000         .000
  9.      7       24.000        28.000         .000
 10.      8       48.000        14.000         .000
 11.      9       24.000          .000         .000
 12.     10       48.000        28.000         .000
 13.     11       72.000        14.000         .000
 14.     12       48.000          .000         .000
 15.     13       72.000        28.000         .000
 16.     14       96.000        14.000         .000
 17.     15       72.000          .000         .000
 18.     16       96.000        28.000         .000
 19.     17      120.000        14.000         .000
 20.     18       96.000          .000         .000
 21.     19      120.000        28.000         .000
 22.     20      144.000        14.000         .000
 23.     21      120.000          .000         .000
 24.     22      144.000        28.000         .000
 25.     23      168.000        14.000         .000
 26.     24      144.000          .000         .000
 27.     25      168.000        28.000         .000
 28.     26      168.000          .000         .000
 29.     27       12.000        14.000         .000
 30.     28       12.000        28.000         .000
 31. MEMBER INCIDENCES
 32.          1          1          27
 33.          3          1          4
 34.          4          5          1
 35.          6          5          28
 36.          7          2          8
 37.          8          2          9
 38.          9          7          2
 39.         10          7          10
 40.         11          8          11
 41.         12          8          12
```

```
42.         13        10         8
43.         14        10        13
44.         15        11        14
45.         16        11        15
46.         17        13        11
47.         18        13        16
48.         19        14        17
49.         20        14        18
50.         21        16        14
51.         22        16        19
52.         23        17        20
53.         24        17        21
54.         25        19        17
55.         26        19        22
56.         27        20        23
57.         28        20        24
58.         29        22        20
59.         30        22        25
60.         31        25        23
61.         32        23        26
62.         35        27         4
63.         36        27         9
64.         39        28         1
65.         40        28         2
66.         41        28         7
67.         42        27         2
68. MEMBER PROPERTY AMERICAN
69. 1 6 7 11 15 19 23 27 41 42 TABLE ST W14X22
70. 10 14 18 22 26 TABLE ST W16X31
71. 30 TABLE ST W18X35
72. 3 4 8 9 12 13 16 17 24 25 28 29 31 32 TABLE ST PIPS80
73. 20 21 TABLE ST PIPD80
74. 35 36 TABLE ST PIPS60
75. 39 40 TABLE ST PIPS50
76. MEMBER RELEASE
77. 1 6 7 10 11 14 15 18 19 22 23 26 27 30 START MZ
78. 7 10 11 14 15 18 19 22 23 26 27 30 41 42 END MZ
79. MEMBER TRUSS
80. 35 36 39 40
81. CONSTANT
82. E STEEL ALL
83. DENSITY STEEL ALL
84. SUPPORT
85. 4 9 12 15 18 21 24 26 FIXED BUT MZ
86. LOAD 1 DEAD LOAD
87. MEMBER LOAD
88. 1 7 11 15 19 23 27 42 UNI GY -.8
89. 6 10 14 18 22 26 30 41 UNI GY -.4
90. LOAD 2 LIVE LOAD
91. MEMBER LOAD
92. 1 7 11 15 19 23 27 42 UNI GY -.2
93. LOAD 3 EARTHQUAKE
94. JOINT LOAD
95. 1 FX 175.
96. 5 FX 194.
97. PERFORM ANALYSIS
```

```
         P R O B L E M   S T A T I S T I C S
         -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =      26/    36/     8
   ORIGINAL/FINAL BAND-WIDTH =    25/      4
   TOTAL PRIMARY LOAD CASES =     3, TOTAL DEGREES OF FREEDOM =     62
   SIZE OF STIFFNESS MATRIX =       806 DOUBLE PREC. WORDS
   REQRD/AVAIL. DISK SPACE =    12.06/ 1288.1 MB, EXMEM = 1956.2 MB

++ Processing Element Stiffness Matrix.            13:16:12
++ Processing Global Stiffness Matrix.             13:16:12
++ Processing Triangular Factorization.            13:16:12
++ Calculating Joint Displacements.                13:16:12
++ Calculating Member  Forces.                     13:16:12

  98. PRINT ANALYSIS RESULTS
  JOINT DISPLACEMENT (INCH RADIANS)    STRUCTURE TYPE = PLANE
  ------------------

 JOINT  LOAD   X-TRANS   Y-TRANS   Z-TRANS   X-ROTAN   Y-ROTAN   Z-ROTAN

     1     1   -.00190   -.00583    .00000    .00000    .00000   -.00002
           2    .00001   -.00063    .00000    .00000    .00000    .00000
           3    .80252    .07831    .00000    .00000    .00000   -.00412
     2     1    .00197   -.01575    .00000    .00000    .00000   -.00002
           2    .00001   -.00229    .00000    .00000    .00000    .00000
           3    .66848   -.07831    .00000    .00000    .00000   -.00368
     4     1    .00000    .00000    .00000    .00000    .00000    .00003
           2    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00510
     5     1    .00578   -.00711    .00000    .00000    .00000   -.00006
           2    .00096   -.00063    .00000    .00000    .00000   -.00001
           3   1.38319    .07853    .00000    .00000    .00000   -.00313
     7     1    .00578   -.02034    .00000    .00000    .00000   -.00003
           2    .00096   -.00229    .00000    .00000    .00000   -.00001
           3   1.23504   -.07809    .00000    .00000    .00000   -.00322
     8     1    .00199   -.01986    .00000    .00000    .00000   -.00002
           2    .00003   -.00331    .00000    .00000    .00000    .00000
           3    .66710    .00000    .00000    .00000    .00000   -.00368
     9     1    .00000    .00000    .00000    .00000    .00000   -.00001
           2    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00413
    10     1    .00577   -.02648    .00000    .00000    .00000   -.00003
           2    .00095   -.00331    .00000    .00000    .00000   -.00001
           3   1.23553    .00000    .00000    .00000    .00000   -.00324
    11     1    .00201   -.01986    .00000    .00000    .00000   -.00002
           2    .00004   -.00331    .00000    .00000    .00000    .00000
           3    .66593    .00000    .00000    .00000    .00000   -.00368
    12     1    .00000    .00000    .00000    .00000    .00000   -.00001
           2    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00412
    13     1    .00576   -.02648    .00000    .00000    .00000   -.00002
           2    .00095   -.00331    .00000    .00000    .00000   -.00001
           3   1.23595    .00000    .00000    .00000    .00000   -.00325
    14     1    .00203   -.00783    .00000    .00000    .00000   -.00002
           2    .00005   -.00131    .00000    .00000    .00000    .00000
           3    .66494    .00000    .00000    .00000    .00000   -.00368
    15     1    .00000    .00000    .00000    .00000    .00000   -.00001
           2    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00411
    16     1    .00575   -.01044    .00000    .00000    .00000   -.00002
           2    .00095   -.00131    .00000    .00000    .00000   -.00001
           3   1.23630    .00000    .00000    .00000    .00000   -.00326
    17     1    .00204   -.01986    .00000    .00000    .00000   -.00002
           2    .00005   -.00331    .00000    .00000    .00000    .00000
           3    .66439    .00000    .00000    .00000    .00000   -.00368
    18     1    .00000    .00000    .00000    .00000    .00000   -.00001
           2    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00410
```

```
JOINT DISPLACEMENT (INCH RADIANS)    STRUCTURE TYPE = PLANE
------------------

JOINT  LOAD   X-TRANS   Y-TRANS   Z-TRANS   X-ROTAN   Y-ROTAN   Z-ROTAN

  19     1    .00575   -.02648    .00000    .00000    .00000   -.00002
         2    .00095   -.00331    .00000    .00000    .00000   -.00001
         3   1.23650    .00000    .00000    .00000    .00000   -.00327
  20     1    .00205   -.01986    .00000    .00000    .00000   -.00002
         2    .00005   -.00331    .00000    .00000    .00000    .00000
         3    .66402    .00000    .00000    .00000    .00000   -.00368
  21     1    .00000    .00000    .00000    .00000    .00000   -.00001
         2    .00000    .00000    .00000    .00000    .00000    .00000
         3    .00000    .00000    .00000    .00000    .00000   -.00409
  22     1    .00575   -.02648    .00000    .00000    .00000   -.00002
         2    .00094   -.00331    .00000    .00000    .00000   -.00001
         3   1.23663    .00000    .00000    .00000    .00000   -.00327
  23     1    .00205   -.00993    .00000    .00000    .00000   -.00002
         2    .00006   -.00166    .00000    .00000    .00000    .00000
         3    .66383    .00000    .00000    .00000    .00000   -.00368
  24     1    .00000    .00000    .00000    .00000    .00000   -.00001
         2    .00000    .00000    .00000    .00000    .00000    .00000
         3    .00000    .00000    .00000    .00000    .00000   -.00409
  25     1    .00575   -.01324    .00000    .00000    .00000   -.00002
         2    .00094   -.00166    .00000    .00000    .00000   -.00001
         3   1.23669    .00000    .00000    .00000    .00000   -.00328
  26     1    .00000    .00000    .00000    .00000    .00000   -.00001
         2    .00000    .00000    .00000    .00000    .00000    .00000
         3    .00000    .00000    .00000    .00000    .00000   -.00409
  27     1    .00003   -.01414    .00000    .00000    .00000   -.00003
         2    .00001   -.00352    .00000    .00000    .00000   -.00001
         3    .59459    .00000    .00000    .00000    .00000   -.00054
  28     1    .00578   -.02151    .00000    .00000    .00000   -.00005
         2    .00096   -.00146    .00000    .00000    .00000   -.00001
         3   1.23465    .05646    .00000    .00000    .00000   -.00054
```

```
 SUPPORT REACTIONS -UNIT KIP  FEET    STRUCTURE TYPE = PLANE
 -----------------

JOINT  LOAD   FORCE-X   FORCE-Y   FORCE-Z     MOM-X     MOM-Y     MOM Z

    4     1      5.11     14.40       .00       .00       .00       .00
          2      1.27      2.40       .00       .00       .00       .00
          3   -184.31   -328.42       .00       .00       .00       .00
    9     1     -5.11     28.80       .00       .00       .00       .00
          2     -1.27      4.80       .00       .00       .00       .00
          3   -184.24    328.42       .00       .00       .00       .00
   12     1       .00     28.80       .00       .00       .00       .00
          2       .00      4.80       .00       .00       .00       .00
          3      -.07       .00       .00       .00       .00       .00
   15     1       .00     28.80       .00       .00       .00       .00
          2       .00      4.80       .00       .00       .00       .00
          3      -.06       .00       .00       .00       .00       .00
   18     1       .00     28.80       .00       .00       .00       .00
          2       .00      4.80       .00       .00       .00       .00
          3      -.14       .00       .00       .00       .00       .00
   21     1       .00     28.80       .00       .00       .00       .00
          2       .00      4.80       .00       .00       .00       .00
          3      -.06       .00       .00       .00       .00       .00
   24     1       .00     28.80       .00       .00       .00       .00
          2       .00      4.80       .00       .00       .00       .00
          3      -.06       .00       .00       .00       .00       .00
   26     1       .00     14.40       .00       .00       .00       .00
          2       .00      2.40       .00       .00       .00       .00
          3      -.06       .00       .00       .00       .00       .00
```

```
  MEMBER END FORCES    STRUCTURE TYPE = PLANE
  -----------------
  ALL UNITS ARE -- KIP  FEET

 MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION     MOM-Y      MOM-Z

    1     1     1     -2.52      3.64      .00       .00       .00        .00
               27      2.52      5.96      .00       .00       .00     -13.91
          2     1       .00       .92      .00       .00       .00        .00
               27       .00      1.48      .00       .00       .00      -3.39
          3     1    271.76       .00      .00       .00       .00        .00
               27   -271.76       .00      .00       .00       .00        .00

    3     1     1      8.45      -.01      .00       .00       .00       -.09
                4     -8.45       .01      .00       .00       .00        .00
          2     1       .92       .00      .00       .00       .00       -.01
                4      -.92       .00      .00       .00       .00        .00
          3     1   -113.55       .15      .00       .00       .00       2.06
                4    113.55      -.15      .00       .00       .00        .00

    4     1     5      1.86       .01      .00       .00       .00        .00
                1     -1.86      -.01      .00       .00       .00        .09
          2     5       .00       .00      .00       .00       .00        .00
                1       .00       .00      .00       .00       .00        .01
          3     5      -.32      -.15      .00       .00       .00        .00
                1       .32       .15      .00       .00       .00      -2.06

    6     1     5      -.01      1.86      .00       .00       .00        .00
               28       .01      2.94      .00       .00       .00      -6.54
          2     5       .00       .00      .00       .00       .00        .00
               28       .00       .00      .00       .00       .00        .00
          3     5    194.15      -.32      .00       .00       .00        .00
               28   -194.15       .32      .00       .00       .00      -3.84

    7     1     2      -.02      9.60      .00       .00       .00        .00
                8       .02      9.60      .00       .00       .00        .00
          2     2      -.01      2.40      .00       .00       .00        .00
                8       .01      2.40      .00       .00       .00        .00
          3     2       .90       .00      .00       .00       .00        .00
                8      -.90       .00      .00       .00       .00        .00

    8     1     2     22.83       .00      .00       .00       .00       -.02
                9    -22.83       .00      .00       .00       .00        .00
          2     2      3.31       .00      .00       .00       .00       -.01
                9     -3.31       .00      .00       .00       .00        .00
          3     2    113.55       .07      .00       .00       .00        .95
                9   -113.55      -.07      .00       .00       .00        .00

    9     1     7      6.66       .00      .00       .00       .00        .00
                2     -6.66       .00      .00       .00       .00        .02
  MEMBER END FORCES    STRUCTURE TYPE = PLANE
  -----------------
  ALL UNITS ARE -- KIP  FEET

 MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION       MOM-Y      MOM-Z

           2     7      .00      .00      .00       .00         .00        .00
                 2      .00      .00      .00       .00         .00        .01
           3     7     -.32     -.07      .00       .00         .00        .00
                 2      .32      .07      .00       .00         .00       -.95

    10     1     7      .01     4.80      .00       .00         .00        .00
                10     -.01     4.80      .00       .00         .00        .00
           2     7      .00      .00      .00       .00         .00        .00
                10      .00      .00      .00       .00         .00        .00
           3     7     -.45      .00      .00       .00         .00        .00
                10      .45      .00      .00       .00         .00        .00

    11     1     8     -.01     9.60      .00       .00         .00        .00
                11      .01     9.60      .00       .00         .00        .00
           2     8     -.01     2.40      .00       .00         .00        .00
                11      .01     2.40      .00       .00         .00        .00
           3     8      .77      .00      .00       .00         .00        .00
                11     -.77      .00      .00       .00         .00        .00

    12     1     8    28.80      .00      .00       .00         .00       -.02
                12   -28.80      .00      .00       .00         .00        .00
           2     8     4.80      .00      .00       .00         .00       -.01
                12    -4.80      .00      .00       .00         .00        .00
           3     8      .00      .07      .00       .00         .00        .92
                12      .00     -.07      .00       .00         .00        .00

    13     1    10     9.60      .00      .00       .00         .00        .00
                 8    -9.60      .00      .00       .00         .00        .02
           2    10      .00      .00      .00       .00         .00        .00
                 8      .00      .00      .00       .00         .00        .01
           3    10      .00     -.07      .00       .00         .00        .00
                 8      .00      .07      .00       .00         .00       -.92

    14     1    10      .01     4.80      .00       .00         .00        .00
                13     -.01     4.80      .00       .00         .00        .00
           2    10      .00      .00      .00       .00         .00        .00
                13      .00      .00      .00       .00         .00        .00
           3    10     -.38      .00      .00       .00         .00        .00
                13      .38      .00      .00       .00         .00        .00

    15     1    11     -.01     9.60      .00       .00         .00        .00
                14      .01     9.60      .00       .00         .00        .00
           2    11     -.01     2.40      .00       .00         .00        .00
                14      .01     2.40      .00       .00         .00        .00
           3    11      .64      .00      .00       .00         .00        .00
                14     -.64      .00      .00       .00         .00        .00

    16     1    11    28.80      .00      .00       .00         .00       -.02
                15   -28.80      .00      .00       .00         .00        .00
 MEMBER END FORCES    STRUCTURE TYPE = PLANE
 -----------------
 ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z    TORSION      MOM-Y       MOM-Z

         2    11      4.80      .00      .00        .00         .00        -.01
              15     -4.80      .00      .00        .00         .00         .00
         3    11       .00      .06      .00        .00         .00         .89
              15       .00     -.06      .00        .00         .00         .00

  17     1    13      9.60      .00      .00        .00         .00         .00
              11     -9.60      .00      .00        .00         .00         .02
         2    13       .00      .00      .00        .00         .00         .00
              11       .00      .00      .00        .00         .00         .01
         3    13       .00     -.06      .00        .00         .00         .00
              11       .00      .06      .00        .00         .00        -.89

  18     1    13       .01     4.80      .00        .00         .00         .00
              16      -.01     4.80      .00        .00         .00         .00
         2    13       .00      .00      .00        .00         .00         .00
              16       .00      .00      .00        .00         .00         .00
         3    13      -.32      .00      .00        .00         .00         .00
              16       .32      .00      .00        .00         .00         .00

  19     1    14      -.01     9.60      .00        .00         .00         .00
              17       .01     9.60      .00        .00         .00         .00
         2    14       .00     2.40      .00        .00         .00         .00
              17       .00     2.40      .00        .00         .00         .00
         3    14       .36      .00      .00        .00         .00         .00
              17      -.36      .00      .00        .00         .00         .00

  20     1    14     28.80      .00      .00        .00         .00        -.04
              18    -28.80      .00      .00        .00         .00         .00
         2    14      4.80      .00      .00        .00         .00        -.02
              18     -4.80      .00      .00        .00         .00         .00
         3    14       .00      .14      .00        .00         .00        1.94
              18       .00     -.14      .00        .00         .00         .00

  21     1    16      9.60      .00      .00        .00         .00         .00
              14     -9.60      .00      .00        .00         .00         .04
         2    16       .00      .00      .00        .00         .00         .00
              14       .00      .00      .00        .00         .00         .02
         3    16       .00     -.14      .00        .00         .00         .00
              14       .00      .14      .00        .00         .00       -1.94

  22     1    16       .00     4.80      .00        .00         .00         .00
              19       .00     4.80      .00        .00         .00         .00
         2    16       .00      .00      .00        .00         .00         .00
              19       .00      .00      .00        .00         .00         .00
         3    16      -.18      .00      .00        .00         .00         .00
              19       .18      .00      .00        .00         .00         .00

  23     1    17       .00     9.60      .00        .00         .00         .00
              20       .00     9.60      .00        .00         .00         .00
 MEMBER END FORCES    STRUCTURE TYPE = PLANE
 -----------------
 ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION     MOM-Y      MOM-Z

          2   17       .00     2.40      .00       .00        .00        .00
              20       .00     2.40      .00       .00        .00        .00
          3   17       .24      .00      .00       .00        .00        .00
              20      -.24      .00      .00       .00        .00        .00

   24     1   17     28.80      .00      .00       .00        .00       -.02
              21    -28.80      .00      .00       .00        .00        .00
          2   17      4.80      .00      .00       .00        .00       -.01
              21     -4.80      .00      .00       .00        .00        .00
          3   17       .00      .06      .00       .00        .00        .86
              21       .00     -.06      .00       .00        .00        .00

   25     1   19      9.60      .00      .00       .00        .00        .00
              17     -9.60      .00      .00       .00        .00        .02
          2   19       .00      .00      .00       .00        .00        .00
              17       .00      .00      .00       .00        .00        .01
          3   19       .00     -.06      .00       .00        .00        .00
              17       .00      .06      .00       .00        .00       -.86

   26     1   19       .00     4.80      .00       .00        .00        .00
              22       .00     4.80      .00       .00        .00        .00
          2   19       .00      .00      .00       .00        .00        .00
              22       .00      .00      .00       .00        .00        .00
          3   19      -.12      .00      .00       .00        .00        .00
              22       .12      .00      .00       .00        .00        .00

   27     1   20       .00     9.60      .00       .00        .00        .00
              23       .00     9.60      .00       .00        .00        .00
          2   20       .00     2.40      .00       .00        .00        .00
              23       .00     2.40      .00       .00        .00        .00
          3   20       .12      .00      .00       .00        .00        .00
              23      -.12      .00      .00       .00        .00        .00

   28     1   20     28.80      .00      .00       .00        .00       -.02
              24    -28.80      .00      .00       .00        .00        .00
          2   20      4.80      .00      .00       .00        .00       -.01
              24     -4.80      .00      .00       .00        .00        .00
          3   20       .00      .06      .00       .00        .00        .85
              24       .00     -.06      .00       .00        .00        .00

   29     1   22      9.60      .00      .00       .00        .00        .00
              20     -9.60      .00      .00       .00        .00        .02
          2   22       .00      .00      .00       .00        .00        .00
              20       .00      .00      .00       .00        .00        .01
          3   22       .00     -.06      .00       .00        .00        .00
              20       .00      .06      .00       .00        .00       -.85

   30     1   22       .00     4.80      .00       .00        .00        .00
              25       .00     4.80      .00       .00        .00        .00
```

```
MEMBER END FORCES    STRUCTURE TYPE = PLANE
-----------------
ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION     MOM-Y      MOM-Z

          2   22       .00       .00      .00       .00       .00       .00
              25       .00       .00      .00       .00       .00       .00
          3   22      -.06       .00      .00       .00       .00       .00
              25       .06       .00      .00       .00       .00       .00

   31     1   25      4.80       .00      .00       .00       .00       .00
              23     -4.80       .00      .00       .00       .00       .02
          2   25       .00       .00      .00       .00       .00       .00
              23       .00       .00      .00       .00       .00       .01
          3   25       .00      -.06      .00       .00       .00       .00
              23       .00       .06      .00       .00       .00      -.84

   32     1   23     14.40       .00      .00       .00       .00      -.02
              26    -14.40       .00      .00       .00       .00       .00
          2   23      2.40       .00      .00       .00       .00      -.01
              26     -2.40       .00      .00       .00       .00       .00
          3   23       .00       .06      .00       .00       .00       .84
              26       .00      -.06      .00       .00       .00       .00

   35     1   27      7.84       .00      .00       .00       .00       .00
               4     -7.84       .00      .00       .00       .00       .00
          2   27      1.95       .00      .00       .00       .00       .00
               4     -1.95       .00      .00       .00       .00       .00
          3   27   -282.99       .00      .00       .00       .00       .00
               4    282.99       .00      .00       .00       .00       .00

   36     1   27      7.86       .00      .00       .00       .00       .00
               9     -7.86       .00      .00       .00       .00       .00
          2   27      1.96       .00      .00       .00       .00       .00
               9     -1.96       .00      .00       .00       .00       .00
          3   27    282.99       .00      .00       .00       .00       .00
               9   -282.99       .00      .00       .00       .00       .00

   39     1   28      3.89       .00      .00       .00       .00       .00
               1     -3.89       .00      .00       .00       .00       .00
          2   28       .00       .00      .00       .00       .00       .00
               1       .00       .00      .00       .00       .00       .00
          3   28   -149.14       .00      .00       .00       .00       .00
               1    149.14       .00      .00       .00       .00       .00

   40     1   28      3.87       .00      .00       .00       .00       .00
               2     -3.87       .00      .00       .00       .00       .00
          2   28       .00       .00      .00       .00       .00       .00
               2       .00       .00      .00       .00       .00       .00
          3   28    149.98       .00      .00       .00       .00       .00
               2   -149.98       .00      .00       .00       .00       .00

   41     1   28       .01      2.94      .00       .00       .00      6.54
               7      -.01      1.86      .00       .00       .00       .00
```

```
  MEMBER END FORCES    STRUCTURE TYPE = PLANE
  -----------------
  ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL  SHEAR-Y  SHEAR-Z   TORSION     MOM-Y     MOM-Z

           2  28       .00      .00      .00       .00       .00       .00
               7       .00      .00      .00       .00       .00       .00
           3  28      -.52      .32      .00       .00       .00      3.84
               7       .52     -.32      .00       .00       .00       .00

    42     1  27     -2.54     5.96      .00       .00       .00     13.91
               2      2.54     3.64      .00       .00       .00       .00
           2  27      -.01     1.48      .00       .00       .00      3.39
               2       .01      .92      .00       .00       .00       .00
           3  27    -96.57      .00      .00       .00       .00       .00
               2     96.57      .00      .00       .00       .00       .00

  ************** END OF LATEST ANALYSIS RESULT **************

    99. DRAW JOINT MEMB SUPP PROP
```

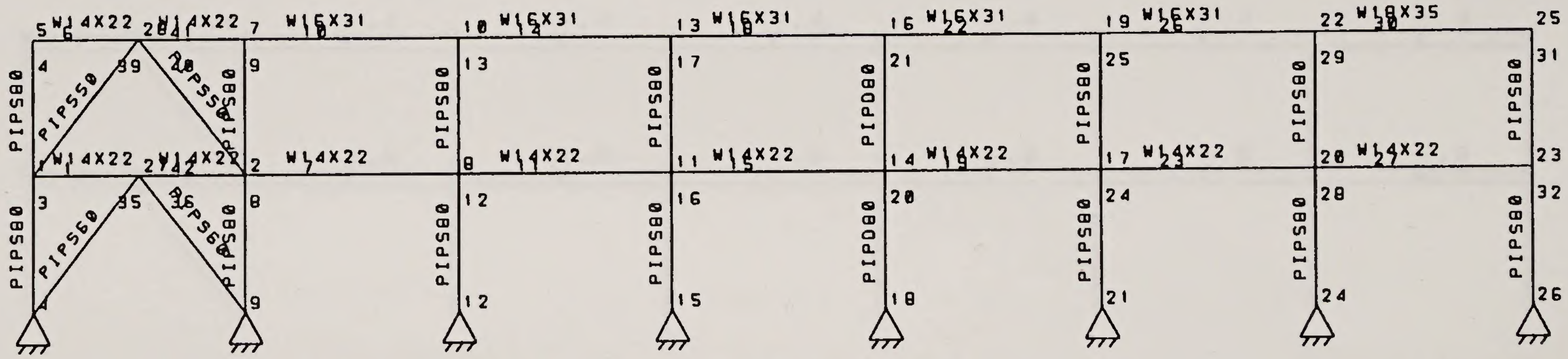
FILE BOISDOL2.STD

S T A A D -III
REV: 22.3a

STRUCTURE DATA:

TYPE = PLANE
NJ = 26
NM = 36
NE = 0
NS = 8
NL = 3
UNIT FEET KIP
XMAX= 168.0
YMAX= 28.0
ZMAX= .0

DATE:SEP 20,1999
TIME: 13:16:13



DRAW JOINT MEMB SUPP PROP

```
100. DRAW LOAD 1 VAL
```

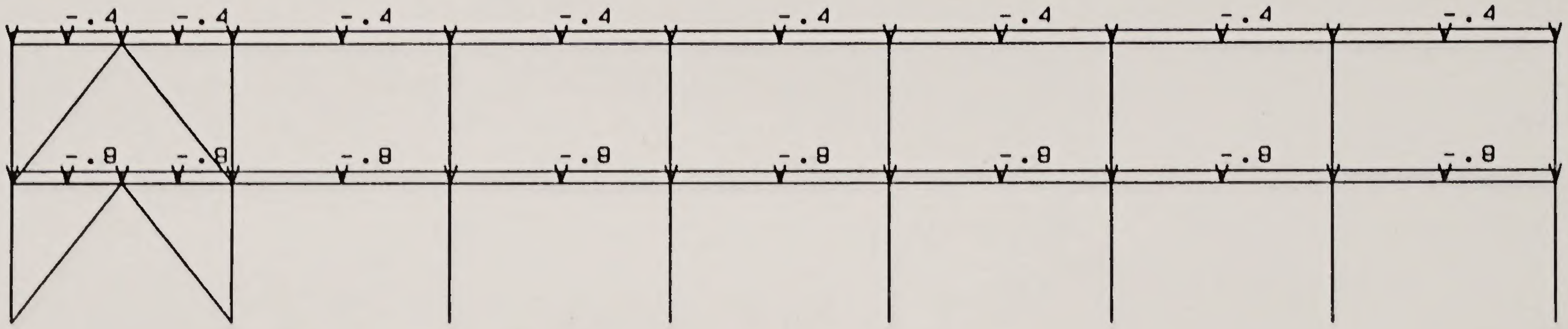
S T A A D -III
REV: 22.3a

STRUCTURE DATA:

TYPE = PLANE
NJ = 26
NM = 36
NE = 0
NS = 8
NL = 3
UNIT FEET KIP
XMAX= 168.0
YMAX= 28.0
ZMAX= .0

DATE:SEP 20,1999
TIME: 13:16:13

LN= 1

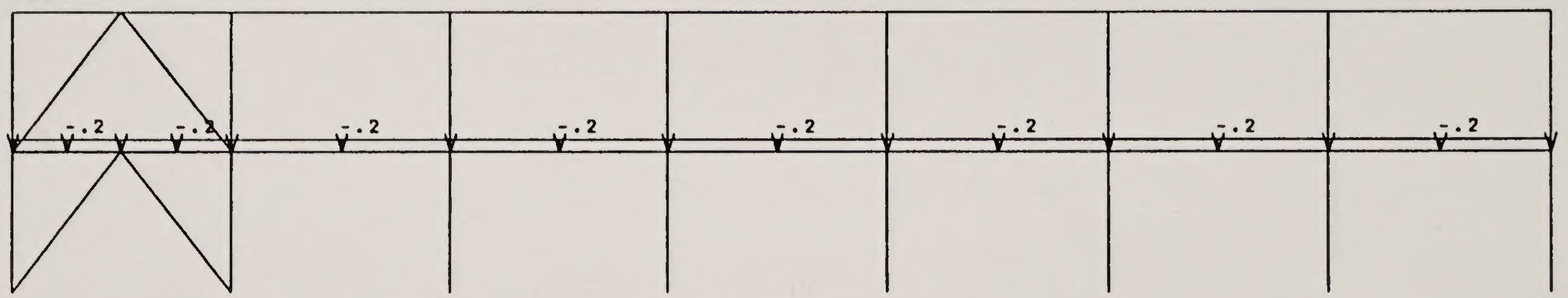


DRAW LOAD 1 VAL

```
101. DRAW LOAD 2 VAL
```

```
S T A A D -III
 REV: 22.3a

STRUCTURE DATA:

 TYPE = PLANE
 NJ =     26
 NM =     36
 NE =      0
 NS =      8
 NL =      3
 UNIT FEE  KIP
 XMAX=   168.0
 YMAX=    28.0
 ZMAX=      .0

DATE:SEP 20,1999
TIME: 13:16:13
```

LN= 2

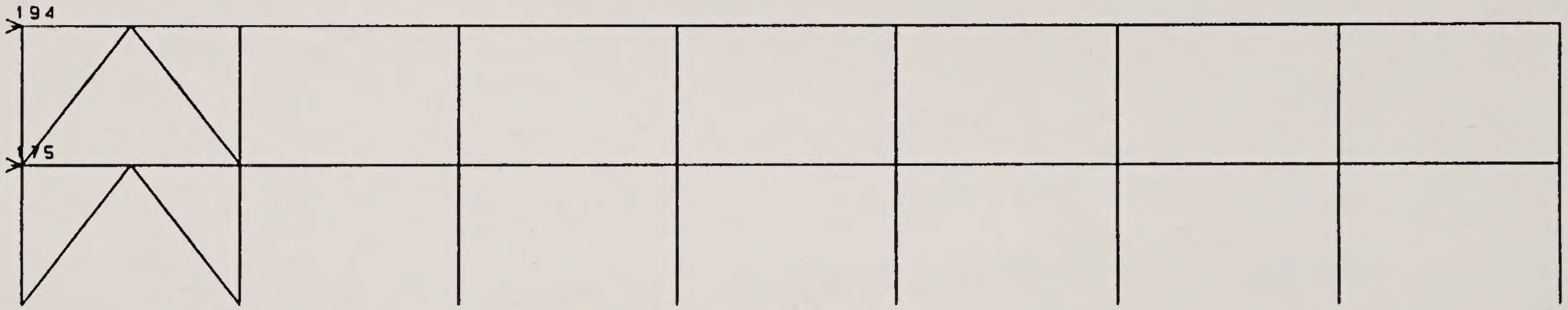


DRAW LOAD 2 VAL

```
102. DRAW LOAD 3 VAL
```

```
S T A A D -III
 REV: 22.3a

STRUCTURE DATA:

 TYPE = PLANE
 NJ =     26
 NM =     36
 NE =      0
 NS =      8
 NL =      3
 UNIT FEE  KIP
 XMAX=   168.0
 YMAX=    28.0
 ZMAX=      .0

DATE:SEP 20,1999
TIME: 13:16:13
```

LN= 3



DRAW LOAD 3 VAL

```
103. FINISH


           *************** END OF STAAD-III ***************

             **** DATE= SEP 20,1999   TIME= 13:16:13 ****

      *********************************************************
      *
```

Appendix E -- Evaluation Phase Calculations (Tier 2)

(STAAD Planar Frame File: BOISDOT2.ANL)

```
          *****************************************************
          *                                                   *
          *              S T A A D - III                      *
          *              Revision 22.3a                       *
          *              Proprietary Program of               *
          *              Research Engineers, Inc.             *
          *              Date=    SEP 20, 1999                *
          *              Time=    14:16:51                    *
          *              Build No.    2415                    *
          *         USER ID: Bureau of Reclamation            *
          *****************************************************

  1. STAAD PLANE FILE BOISDOT2.STD
  2. INPUT WIDTH 72
  3. UNIT FEET KIP
  4. JOINT COORDINATES
  5.     60       24.000         14.000          .000
  6.     61       24.000         28.000          .000
  7.     62       48.000         14.000          .000
  8.     63       24.000           .000          .000
  9.     64       48.000         28.000          .000
 10.     65       72.000         14.000          .000
 11.     66       48.000           .000          .000
 12.     67       72.000         28.000          .000
 13.     68       72.000           .000          .000
 14.     69       36.000           .000          .000
 15.     70       36.000         28.000          .000
 16.     71       36.000         14.000          .000
 17.     72       96.000         14.000          .000
 18.     73       96.000         28.000          .000
 19.     74       96.000           .000          .000
 20. MEMBER INCIDENCES
 21.          60        60        71
 22.          61        60        63
 23.          62        61        60
 24.          63        61        70
 25.          64        62        65
 26.          65        62        66
 27.          66        64        62
 28.          67        64        67
 29.          68        65        68
 30.          69        67        65
 31.          70        60        69
 32.          71        62        69
 33.          72        61        71
 34.          73        64        71
 35.          74        70        64
 36.          75        71        62
 37.          76        65        72
 38.          77        67        73
 39.          78        72        74
 40.          79        73        72
 41. MEMBER PROPERTY AMERICAN
```

```
  42. 70 71 TABLE ST PIPS60
  43. 72 73 TABLE ST PIPS50
  44. 60 63 74 TO 77 TABLE ST W14X22
  45. 64 67 TABLE ST M14X18
  46. 61 62 65 66 TABLE ST PIPD80
  47. 68 69 78 79 TABLE ST PIPS80
  48. MEMBER RELEASE
  49. 60 63 64 67 76 77 START MZ
  50. 64 67 74 TO 77 END MZ
  51. MEMBER TRUSS
  52. 70 TO 73
  53. MEMBER TRUSS
  54. 70 TO 73
  55. CONSTANT
  56. E STEEL ALL
  57. DENSITY STEEL ALL
  58. SUPPORT
  59. 63 66 68 69 FIXED BUT MZ
  60. 74 FIXED BUT MZ
  61. LOAD 1 DEAD LOAD
  62. MEMBER LOAD
  63. 60 64 75 76 UNI GY -.6
  64. 63 67 74 77 UNI GY -.3
  65. JOINT LOAD
  66. 64 67 FY -50.
  67. 61 73 FY -25.
  68. LOAD 2 LIVE LOAD
  69. MEMBER LOAD
  70. 60 64 75 76 UNI GY -.2
  71. JOINT LOAD
  72. 64 67 FY -10.
  73. 61 73 FY -5.
  74. LOAD 3 EARTHQUAKE
  75. JOINT LOAD
  76. 60 FX 210.
  77. 61 FX 232.
  78. PERFORM ANALYSIS


        P R O B L E M   S T A T I S T I C S
        -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     15/    20/     5
   ORIGINAL/FINAL BAND-WIDTH =    11/     4
   TOTAL PRIMARY LOAD CASES  =     3, TOTAL DEGREES OF FREEDOM =     35
   SIZE OF STIFFNESS MATRIX =      420 DOUBLE PREC. WORDS
   REQRD/AVAIL. DISK SPACE =  12.03/ 1286.4 MB,  EXMEM = 1955.0 MB

++ Processing Element Stiffness Matrix.            14:16:51
++ Processing Global Stiffness Matrix.             14:16:52
++ Processing Triangular Factorization.            14:16:52
++ Calculating Joint Displacements.                14:16:52
++ Calculating Member  Forces.                     14:16:52


  79. PRINT ANALYSIS RESULTS
```

```
   JOINT DISPLACEMENT (INCH RADIANS)    STRUCTURE TYPE = PLANE
   ------------------

 JOINT  LOAD   X-TRANS    Y-TRANS    Z-TRANS    X-ROTAN    Y-ROTAN    Z-ROTAN

    60     1     .00272    -.00850     .00000     .00000     .00000    -.00006
           2     .00056    -.00176     .00000     .00000     .00000    -.00001
           3     .90391     .11277     .00000     .00000     .00000    -.00497
    61     1     .01871    -.01745     .00000     .00000     .00000    -.00011
           2     .00409    -.00351     .00000     .00000     .00000    -.00003
           3    1.66956     .14975     .00000     .00000     .00000    -.00435
    62     1     .00866    -.01823     .00000     .00000     .00000    -.00004
           2     .00179    -.00377     .00000     .00000     .00000    -.00001
           3     .77149    -.10109     .00000     .00000     .00000    -.00444
    63     1     .00000     .00000     .00000     .00000     .00000     .00000
           2     .00000     .00000     .00000     .00000     .00000     .00000
           3     .00000     .00000     .00000     .00000     .00000    -.00558
    64     1     .01307    -.03496     .00000     .00000     .00000    -.00002
           2     .00219    -.00688     .00000     .00000     .00000     .00000
           3    1.49256    -.13784     .00000     .00000     .00000    -.00422
    65     1     .00864    -.04938     .00000     .00000     .00000    -.00004
           2     .00178    -.01021     .00000     .00000     .00000    -.00001
           3     .77124     .00000     .00000     .00000     .00000    -.00444
    66     1     .00000     .00000     .00000     .00000     .00000    -.00006
           2     .00000     .00000     .00000     .00000     .00000    -.00001
           3     .00000     .00000     .00000     .00000     .00000    -.00467
    67     1     .01308    -.08883     .00000     .00000     .00000    -.00002
           2     .00220    -.01710     .00000     .00000     .00000     .00000
           3    1.49269     .00000     .00000     .00000     .00000    -.00422
    68     1     .00000     .00000     .00000     .00000     .00000    -.00006
           2     .00000     .00000     .00000     .00000     .00000    -.00001
           3     .00000     .00000     .00000     .00000     .00000    -.00466
    69     1     .00000     .00000     .00000     .00000     .00000     .00000
           2     .00000     .00000     .00000     .00000     .00000     .00000
           3     .00000     .00000     .00000     .00000     .00000     .00000
    70     1     .01589    -.41992     .00000     .00000     .00000    -.00006
           2     .00314    -.00520     .00000     .00000     .00000    -.00001
           3    1.58106     .00595     .00000     .00000     .00000    -.00100
    71     1     .00569    -.04193     .00000     .00000     .00000    -.00003
           2     .00117    -.01047     .00000     .00000     .00000    -.00001
           3     .92659    -.06860     .00000     .00000     .00000    -.00074
    72     1     .00863    -.02469     .00000     .00000     .00000    -.00004
           2     .00178    -.00510     .00000     .00000     .00000    -.00001
           3     .77113     .00000     .00000     .00000     .00000    -.00444
    73     1     .01308    -.04441     .00000     .00000     .00000    -.00002
           2     .00220    -.00855     .00000     .00000     .00000     .00000
           3    1.49274     .00000     .00000     .00000     .00000    -.00422
    74     1     .00000     .00000     .00000     .00000     .00000    -.00006
           2     .00000     .00000     .00000     .00000     .00000    -.00001
           3     .00000     .00000     .00000     .00000     .00000    -.00466
   SUPPORT REACTIONS -UNIT KIP  FEET    STRUCTURE TYPE = PLANE
   -----------------

 JOINT  LOAD   FORCE-X   FORCE-Y    FORCE-Z      MOM-X      MOM-Y      MOM Z

    63    1      .02     31.24        .00        .00        .00        .00
          2      .00      6.46        .00        .00        .00        .00
          3     -.20   -414.63        .00        .00        .00        .00
    66    1     -.01     67.04        .00        .00        .00        .00
          2      .00     13.86        .00        .00        .00        .00
          3     -.07    371.70        .00        .00        .00        .00
    68    1      .00     71.60        .00        .00        .00        .00
          2      .00     14.80        .00        .00        .00        .00
          3     -.03       .00        .00        .00        .00        .00
    69    1     -.01      9.12        .00        .00        .00        .00
          2      .00      1.89        .00        .00        .00        .00
          3  -441.65     42.93        .00        .00        .00        .00
    74    1      .00     35.80        .00        .00        .00        .00
          2      .00      7.40        .00        .00        .00        .00
          3     -.03       .00        .00        .00        .00        .00
```

```
  MEMBER END FORCES    STRUCTURE TYPE = PLANE
  -----------------
  ALL UNITS ARE -- KIP  FEET

 MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION     MOM-Y      MOM-Z

    60    1    60     -3.87     2.88      .00        .00       .00        .00
               71      3.87     4.32      .00        .00       .00      -8.65
          2    60      -.80      .95      .00        .00       .00        .00
               71       .80     1.45      .00        .00       .00      -3.01
          3    60    -29.64      .42      .00        .00       .00        .00
               71     29.64     -.42      .00        .00       .00       5.09

    61    1    60     31.24     -.02      .00        .00       .00       -.28
               63    -31.24      .02      .00        .00       .00        .00
          2    60      6.46      .00      .00        .00       .00       -.06
               63     -6.46      .00      .00        .00       .00        .00
          3    60   -414.63      .20      .00        .00       .00       2.87
               63    414.63     -.20      .00        .00       .00        .00

    62    1    61     32.93      .02      .00        .00       .00        .00
               60    -32.93     -.02      .00        .00       .00        .28
          2    61      6.45      .00      .00        .00       .00        .00
               60     -6.45      .00      .00        .00       .00        .06
          3    61   -135.96     -.20      .00        .00       .00        .00
               60    135.96      .20      .00        .00       .00      -2.87

    63    1    61      3.69     3.60      .00        .00       .00        .00
               70     -3.69      .00      .00        .00       .00      21.60
          2    61      1.24      .00      .00        .00       .00        .00
               70     -1.24      .00      .00        .00       .00        .00
          3    61    115.67      .00      .00        .00       .00        .00
               70   -115.67      .00      .00        .00       .00        .00

    64    1    62       .01     7.20      .00        .00       .00        .00
               65      -.01     7.20      .00        .00       .00        .00
          2    62       .00     2.40      .00        .00       .00        .00
               65       .00     2.40      .00        .00       .00        .00
          3    62       .13      .00      .00        .00       .00        .00
               65      -.13      .00      .00        .00       .00        .00

    65    1    62     67.04      .01      .00        .00       .00        .09
               66    -67.04     -.01      .00        .00       .00        .00
          2    62     13.86      .00      .00        .00       .00        .03
               66    -13.86      .00      .00        .00       .00        .00
          3    62    371.70      .07      .00        .00       .00       1.05
               66   -371.70     -.07      .00        .00       .00        .00

    66    1    64     61.52     -.01      .00        .00       .00        .00
               62    -61.52      .01      .00        .00       .00       -.09
 MEMBER END FORCES    STRUCTURE TYPE = PLANE
 -----------------
 ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y   SHEAR-Z   TORSION      MOM-Y      MOM-Z

         2    64     11.45       .00       .00       .00        .00        .00
              62    -11.45       .00       .00       .00        .00       -.03
         3    64    135.11      -.07       .00       .00        .00        .00
              62   -135.11       .07       .00       .00        .00      -1.05

  67     1    64      -.01      3.60       .00       .00        .00        .00
              67       .01      3.60       .00       .00        .00        .00
         2    64       .00       .00       .00       .00        .00        .00
              67       .00       .00       .00       .00        .00        .00
         3    64      -.07       .00       .00       .00        .00        .00
              67       .07       .00       .00       .00        .00        .00

  68     1    65     71.60       .00       .00       .00        .00        .04
              68    -71.60       .00       .00       .00        .00        .00
         2    65     14.80       .00       .00       .00        .00        .01
              68    -14.80       .00       .00       .00        .00        .00
         3    65       .00       .03       .00       .00        .00        .46
              68       .00      -.03       .00       .00        .00        .00

  69     1    67     57.20       .00       .00       .00        .00        .00
              65    -57.20       .00       .00       .00        .00       -.04
         2    67     10.00       .00       .00       .00        .00        .00
              65    -10.00       .00       .00       .00        .00       -.01
         3    67       .00      -.03       .00       .00        .00        .00
              65       .00       .03       .00       .00        .00       -.46

  70     1    60      6.01       .00       .00       .00        .00        .00
              69     -6.01       .00       .00       .00        .00        .00
         2    60      1.24       .00       .00       .00        .00        .00
              69     -1.24       .00       .00       .00        .00        .00
         3    60    367.59       .00       .00       .00        .00        .00
              69   -367.59       .00       .00       .00        .00        .00

  71     1    62      6.00       .00       .00       .00        .00        .00
              69     -6.00       .00       .00       .00        .00        .00
         2    62      1.24       .00       .00       .00        .00        .00
              69     -1.24       .00       .00       .00        .00        .00
         3    62   -311.05       .00       .00       .00        .00        .00
              69    311.05       .00       .00       .00        .00        .00

  72     1    61     -5.70       .00       .00       .00        .00        .00
              71      5.70       .00       .00       .00        .00        .00
         2    61     -1.91       .00       .00       .00        .00        .00
              71      1.91       .00       .00       .00        .00        .00
         3    61    179.07       .00       .00       .00        .00        .00
              71   -179.07       .00       .00       .00        .00        .00

  73     1    64     -5.69       .00       .00       .00        .00        .00
              71      5.69       .00       .00       .00        .00        .00
 MEMBER END FORCES    STRUCTURE TYPE = PLANE
 -----------------
 ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z    TORSION     MOM-Y      MOM-Z

         2    64     -1.91       .00      .00        .00       .00        .00
              71      1.91       .00      .00        .00       .00        .00
         3    64   -177.95       .00      .00        .00       .00        .00
              71    177.95       .00      .00        .00       .00        .00

   74    1    70      3.69       .00      .00        .00       .00     -21.60
              64     -3.69      3.60      .00        .00       .00        .00
         2    70      1.24       .00      .00        .00       .00        .00
              64     -1.24       .00      .00        .00       .00        .00
         3    70    115.67       .00      .00        .00       .00        .00
              64   -115.67       .00      .00        .00       .00        .00

   75    1    71     -3.88      4.32      .00        .00       .00       8.65
              62      3.88      2.88      .00        .00       .00        .00
         2    71      -.80      1.45      .00        .00       .00       3.01
              62       .80       .95      .00        .00       .00        .00
         3    71    202.71      -.42      .00        .00       .00      -5.09
              62   -202.71       .42      .00        .00       .00        .00

   76    1    65       .01      7.20      .00        .00       .00        .00
              72      -.01      7.20      .00        .00       .00        .00
         2    65       .00      2.40      .00        .00       .00        .00
              72       .00      2.40      .00        .00       .00        .00
         3    65       .07       .00      .00        .00       .00        .00
              72      -.07       .00      .00        .00       .00        .00

   77    1    67       .00      3.60      .00        .00       .00        .00
              73       .00      3.60      .00        .00       .00        .00
         2    67       .00       .00      .00        .00       .00        .00
              73       .00       .00      .00        .00       .00        .00
         3    67      -.03       .00      .00        .00       .00        .00
              73       .03       .00      .00        .00       .00        .00

   78    1    72     35.80       .00      .00        .00       .00        .04
              74    -35.80       .00      .00        .00       .00        .00
         2    72      7.40       .00      .00        .00       .00        .01
              74     -7.40       .00      .00        .00       .00        .00
         3    72       .00       .03      .00        .00       .00        .46
              74       .00      -.03      .00        .00       .00        .00

   79    1    73     28.60       .00      .00        .00       .00        .00
              72    -28.60       .00      .00        .00       .00       -.04
         2    73      5.00       .00      .00        .00       .00        .00
              72     -5.00       .00      .00        .00       .00       -.01
         3    73       .00      -.03      .00        .00       .00        .00
              72       .00       .03      .00        .00       .00       -.46
```

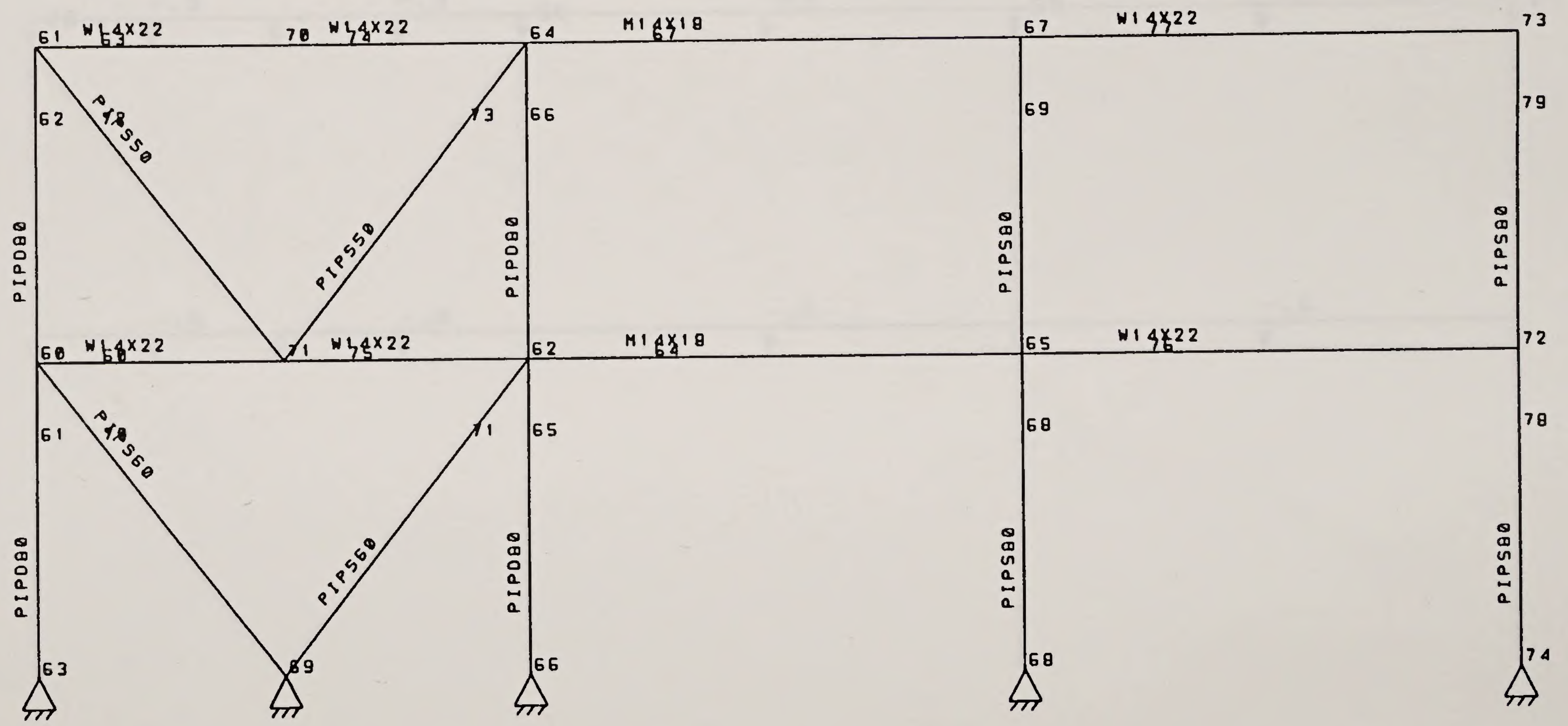
```
************** END OF LATEST ANALYSIS RESULT **************

 80. DRAW JOINT MEMB SUPP PROP
```

S T A A D -III
REV: 22.3a

STRUCTURE DATA:

TYPE = PLANE
NJ = 15
NM = 20
NE = 0
NS = 5
NL = 3
UNIT FEET KIP
XMAX= 72.0
YMAX= 28.0
ZMAX= .0

DATE:SEP 20,1999
TIME: 14:16:52



DRAW JOINT MEMB SUPP PROP

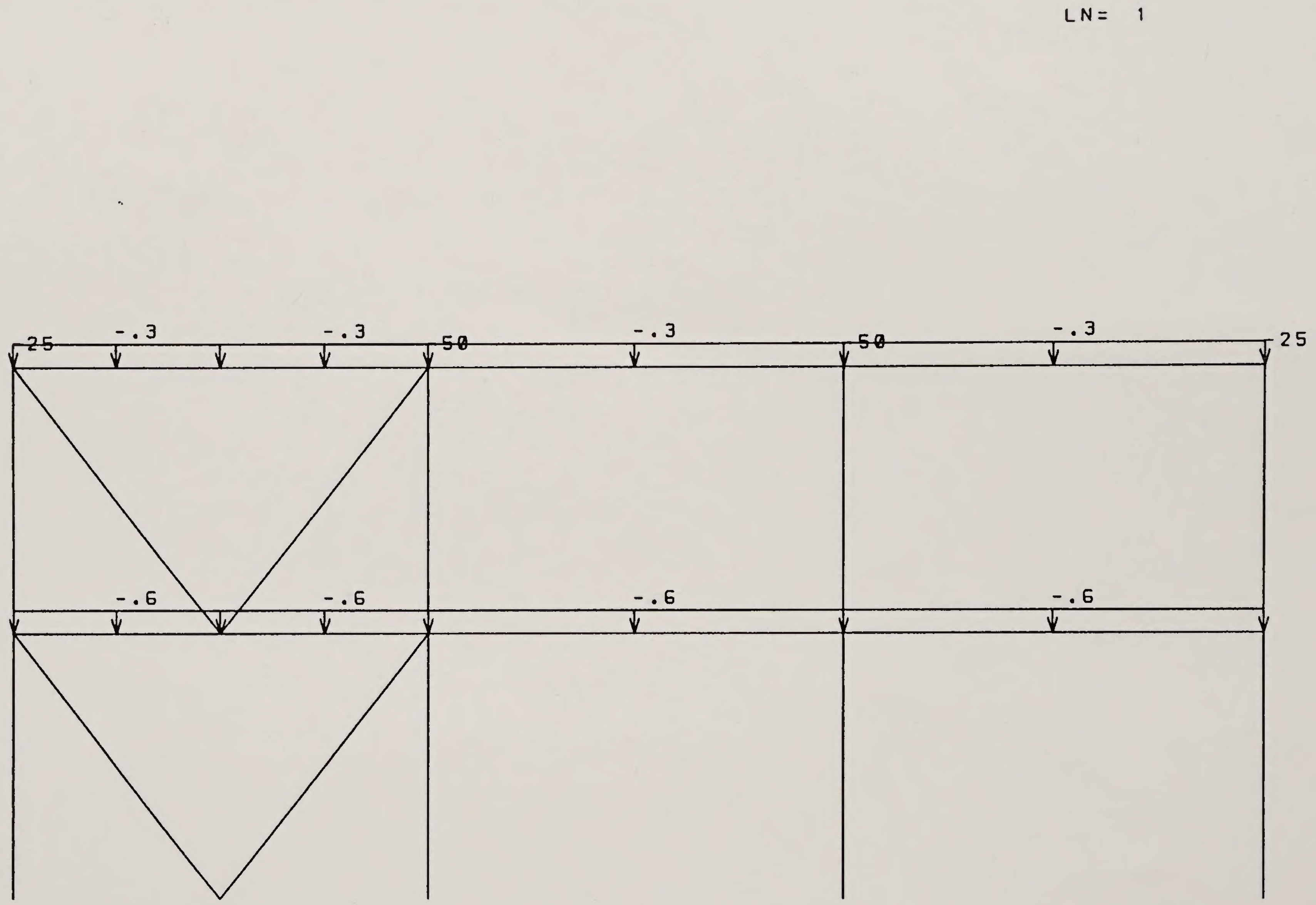
```
81. DRAW LOAD 1 VAL
```

S T A A D -III
REV: 22.3a

STRUCTURE DATA:

TYPE = PLANE
NJ = 15
NM = 20
NE = 0
NS = 5
NL = 3
UNIT FEET KIP
XMAX= 72.0
YMAX= 28.0
ZMAX= .0

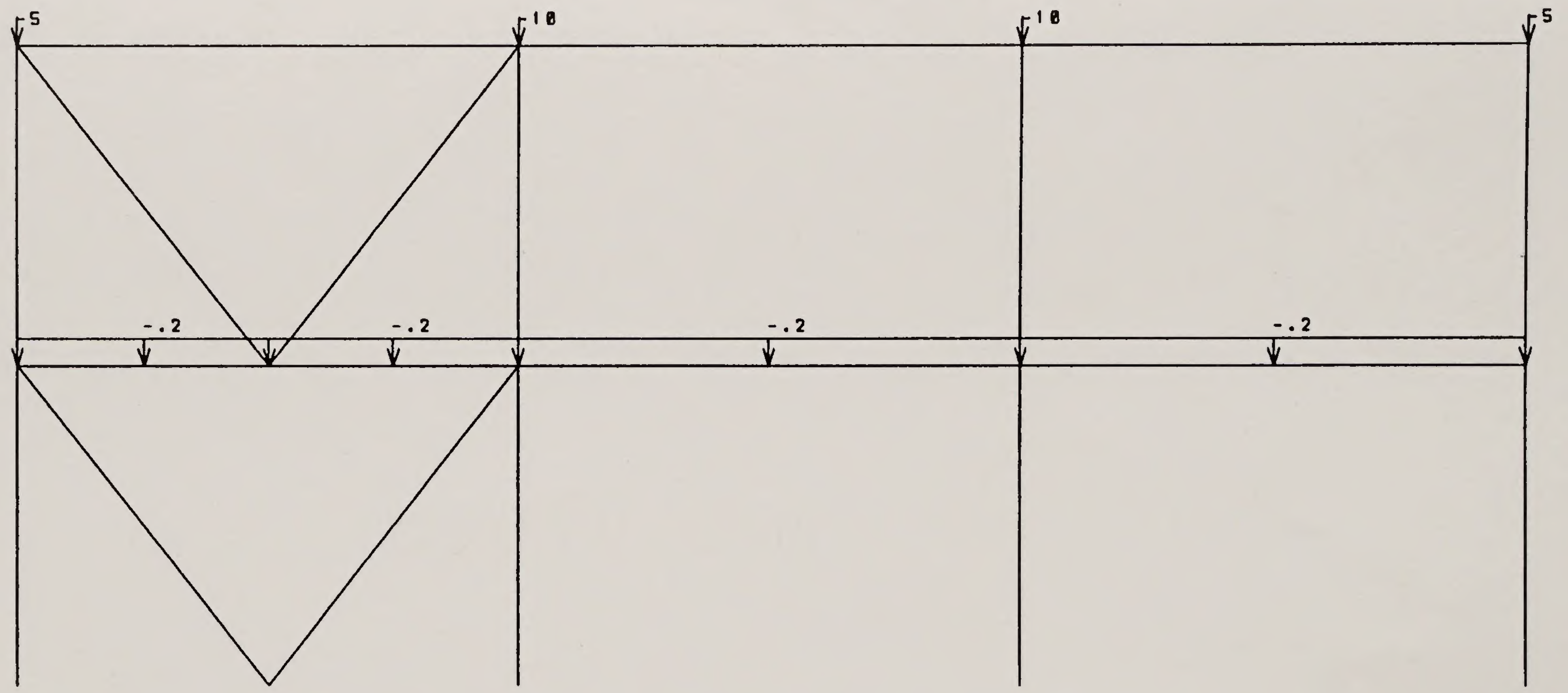
DATE:SEP 20,1999
TIME: 14:16:52



DRAW LOAD 1 VAL

82. DRAW LOAD 2 VAL

```
S T A A D -III
 REV: 22.3a

STRUCTURE DATA:

 TYPE = PLANE
 NJ =      15
 NM =      20
 NE =       0
 NS =       5
 NL =       3
 UNIT FEE  KIP
 XMAX=     72.0
 YMAX=     28.0
 ZMAX=       .0

DATE:SEP 20,1999
TIME: 14:16:52
```

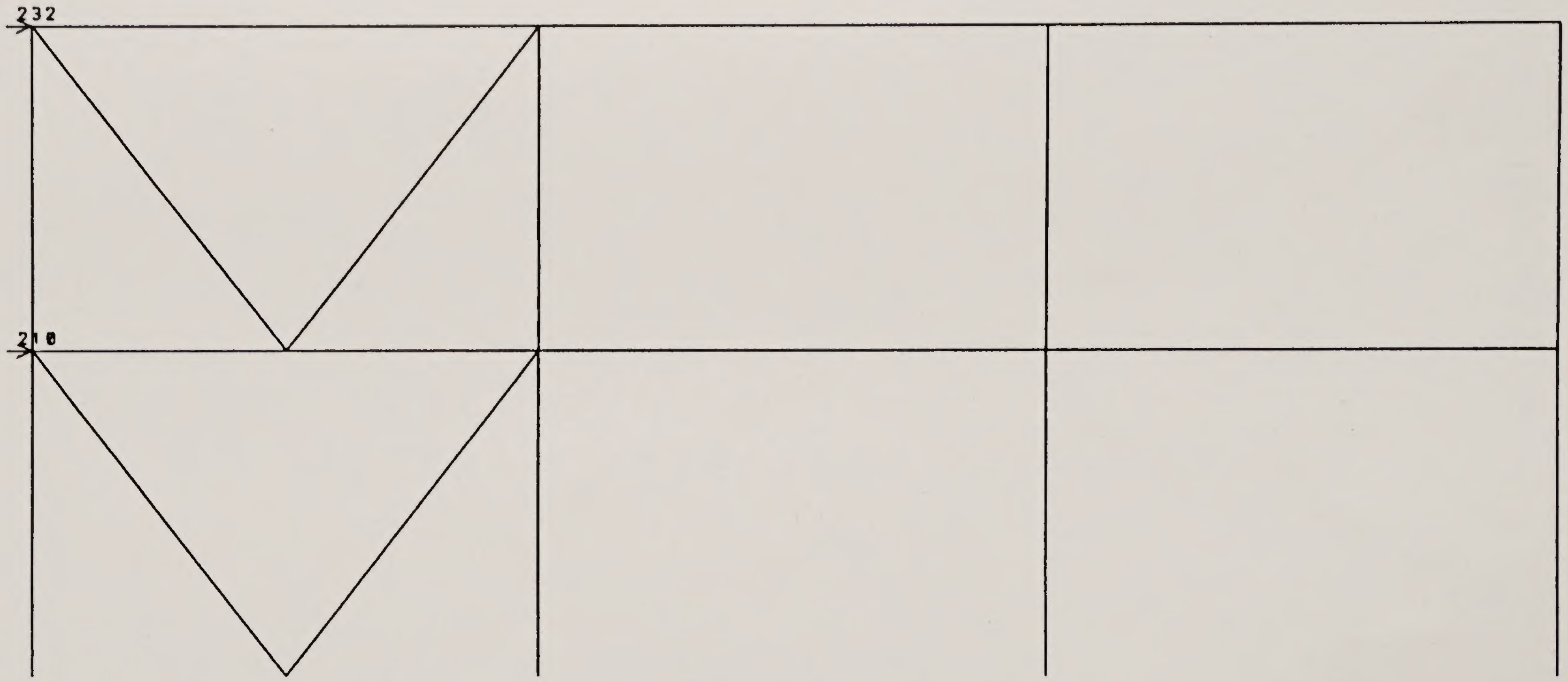


DRAW LOAD 2 VAL

83. DRAW LOAD 3 VAL

```
S T A A D -III
 REV: 22.3o

STRUCTURE DATA:

 TYPE = PLANE
 NJ =     15
 NM =     20
 NE =      0
 NS =      5
 NL =      3
 UNIT FEE   KIP
 XMAX=     72.0
 YMAX=     28.0
 ZMAX=       .0

DATE:SEP 20,1999
TIME: 14:16:52
```

LN= 3



DRAW LOAD 3 VAL

```
84. FINISH


     *************** END OF STAAD-III ***************

       **** DATE= SEP 20,1999   TIME= 14:16:52 ****

     *********************************************************
     *        For questions on  STAAD-III,   contact:        *
     *         Research Engineers, Inc at   Build No.  2415  *
     *  West Coast: Ph- (714) 974-2500  Fax- (714) 921-2543  *
     *  East Coast: Ph- (978) 688-3626  Fax- (978) 685-7230  *
     *********************************************************
```

Appendix E -- Evaluation Phase Calculations (Tier 2)

(STAAD Planar Frame File: BOISDOL1.ANL)

```
          ****************************************************
          *                                                  *
          *            S T A A D - III                       *
          *            Revision 22.3a                        *
          *            Proprietary Program of                *
          *            Research Engineers, Inc.              *
          *            Date=     SEP 20, 1999                *
          *            Time=     14:38:21                    *
          *            Build No.    2415                     *
          *       USER ID: Bureau of Reclamation             *
          ****************************************************

  1. STAAD PLANE FILE BOISDOL1.STD
  2. INPUT WIDTH 72
  3. UNIT FEET KIP
  4. JOINT COORDINATES
  5.     50         .000        14.000           .000
  6.     51       24.000        14.000           .000
  7.     52         .000        28.000           .000
  8.     53       24.000        28.000           .000
  9.     54       48.000        14.000           .000
 10.     55       48.000        28.000           .000
 11.     56       72.000        14.000           .000
 12.     57       12.000        28.000           .000
 13.     58       72.000        28.000           .000
 14. MEMBER INCIDENCES
 15.          50         52         50
 16.          51         52         57
 17.          52         53         51
 18.          53         53         55
 19.          54         55         54
 20.          55         55         58
 21.          56         58         56
 22.          57         57         50
 23.          58         57         51
 24.          59         57         53
 25. MEMBER PROPERTY AMERICAN
 26. 51 53 55 59 TABLE ST W14X22
 27. 50 52 54 56 TABLE ST PIPS50
 28. 57 58 TABLE ST PIPS40
 29. MEMBER RELEASE
 30. 51 53 55 START MZ
 31. 53 55 59 END MZ
 32. MEMBER TRUSS
 33. 57 58
 34. CONSTANT
 35. E STEEL ALL
 36. DENSITY STEEL ALL
 37. SUPPORT
 38. 50 51 54 56 FIXED BUT MZ
 39. LOAD 1 DEAD LOAD
 40. MEMBER LOAD
 41. 51 53 55 59 UNI GY -.4
```

```
  42. LOAD 3 EARTHQUAKE
  43. JOINT LOAD
  44. 52 FX 52.
  45. PERFORM ANALYSIS


         P R O B L E M   S T A T I S T I C S
         -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =      9/   10/    4
   ORIGINAL/FINAL BAND-WIDTH =      7/    2
   TOTAL PRIMARY LOAD CASES =       2, TOTAL DEGREES OF FREEDOM =     19
   SIZE OF STIFFNESS MATRIX =       133 DOUBLE PREC. WORDS
   REQRD/AVAIL. DISK SPACE =  12.02/ 1282.4 MB,  EXMEM = 1955.0 MB

++ Processing Element Stiffness Matrix.              14:35:50
++ Processing Global Stiffness Matrix.               14:35:50
++ Processing Triangular Factorization.              14:35:50
++ Calculating Joint Displacements.                  14:35:50
++ Calculating Member  Forces.                       14:35:50


  46. PRINT ANALYSIS RESULTS
```

```
   JOINT DISPLACEMENT (INCH RADIANS)    STRUCTURE TYPE = PLANE
   ------------------

 JOINT  LOAD   X-TRANS   Y-TRANS   Z-TRANS   X-ROTAN   Y-ROTAN   Z-ROTAN

    50     1    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00112
    51     1    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00088
    52     1    .00000   -.00249    .00000    .00000    .00000    .00000
           3    .18754    .00000    .00000    .00000    .00000   -.00112
    53     1    .00000   -.00896    .00000    .00000    .00000    .00000
           3    .14776    .00000    .00000    .00000    .00000   -.00088
    54     1    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00088
    55     1    .00000   -.01293    .00000    .00000    .00000    .00000
           3    .14776    .00000    .00000    .00000    .00000   -.00088
    56     1    .00000    .00000    .00000    .00000    .00000    .00000
           3    .00000    .00000    .00000    .00000    .00000   -.00088
    57     1    .00000   -.01232    .00000    .00000    .00000   -.00002
           3    .14776    .00000    .00000    .00000    .00000    .00000
    58     1    .00000   -.00647    .00000    .00000    .00000    .00000
           3    .14776    .00000    .00000    .00000    .00000   -.00088
```

```
  SUPPORT REACTIONS -UNIT KIP  FEET    STRUCTURE TYPE = PLANE
  -----------------

JOINT  LOAD   FORCE-X   FORCE-Y  FORCE-Z     MOM-X     MOM-Y     MOM Z

   50     1      2.53      4.80      .00       .00       .00       .00
          3    -26.00    -30.33      .00       .00       .00       .00
   51     1     -2.53      9.60      .00       .00       .00       .00
          3    -26.00     30.33      .00       .00       .00       .00
   54     1       .00      9.60      .00       .00       .00       .00
          3       .00       .00      .00       .00       .00       .00
   56     1       .00      4.80      .00       .00       .00       .00
          3       .00       .00      .00       .00       .00       .00
```

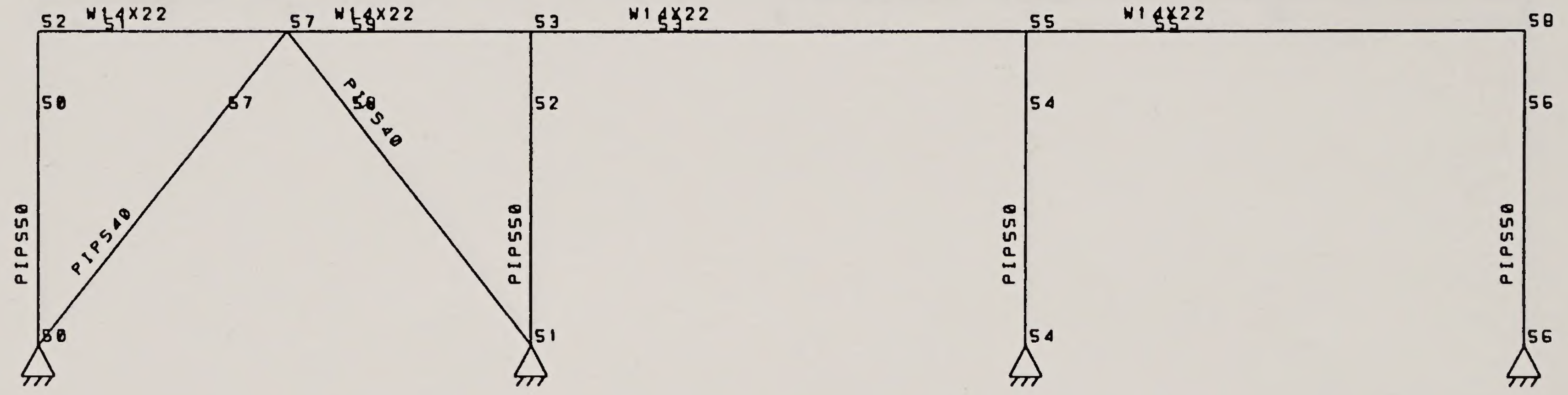
```
 MEMBER END FORCES    STRUCTURE TYPE = PLANE
 -----------------
 ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION     MOM-Y      MOM-Z


  50     1    52      1.85       .00      .00       .00       .00        .00
              50     -1.85       .00      .00       .00       .00        .00
         3    52       .00       .00      .00       .00       .00        .00
              50       .00       .00      .00       .00       .00        .00

  51     1    52       .00      1.85      .00       .00       .00        .00
              57       .00      2.95      .00       .00       .00      -6.62
         3    52     52.00       .00      .00       .00       .00        .00
              57    -52.00       .00      .00       .00       .00        .00

  52     1    53      6.65       .00      .00       .00       .00        .00
              51     -6.65       .00      .00       .00       .00        .00
         3    53       .00       .00      .00       .00       .00        .00
              51       .00       .00      .00       .00       .00        .00

  53     1    53       .00      4.80      .00       .00       .00        .00
              55       .00      4.80      .00       .00       .00        .00
         3    53       .00       .00      .00       .00       .00        .00
              55       .00       .00      .00       .00       .00        .00

  54     1    55      9.60       .00      .00       .00       .00        .00
              54     -9.60       .00      .00       .00       .00        .00
         3    55       .00       .00      .00       .00       .00        .00
              54       .00       .00      .00       .00       .00        .00

  55     1    55       .00      4.80      .00       .00       .00        .00
              58       .00      4.80      .00       .00       .00        .00
         3    55       .00       .00      .00       .00       .00        .00
              58       .00       .00      .00       .00       .00        .00

  56     1    58      4.80       .00      .00       .00       .00        .00
              56     -4.80       .00      .00       .00       .00        .00
         3    58       .00       .00      .00       .00       .00        .00
              56       .00       .00      .00       .00       .00        .00

  57     1    57      3.89       .00      .00       .00       .00        .00
              50     -3.89       .00      .00       .00       .00        .00
         3    57    -39.95       .00      .00       .00       .00        .00
              50     39.95       .00      .00       .00       .00        .00

  58     1    57      3.89       .00      .00       .00       .00        .00
              51     -3.89       .00      .00       .00       .00        .00
         3    57     39.95       .00      .00       .00       .00        .00
              51    -39.95       .00      .00       .00       .00        .00
 MEMBER END FORCES    STRUCTURE TYPE = PLANE
 -----------------
 ALL UNITS ARE -- KIP  FEET

MEMBER  LOAD  JT     AXIAL   SHEAR-Y  SHEAR-Z   TORSION     MOM-Y       MOM-Z

  59      1    57      .00      2.95      .00       .00       .00        6.62
               53      .00      1.85      .00       .00       .00         .00
          3    57      .00       .00      .00       .00       .00         .00
               53      .00       .00      .00       .00       .00         .00

 ************** END OF LATEST ANALYSIS RESULT **************

  47. DRAW JOINT MEMB SUPP PROP
```

S T A A D -III
REV: 22.3a

STRUCTURE DATA:

TYPE = PLANE
NJ = 9
NM = 10
NE = 0
NS = 4
NL = 2
UNIT FEET KIP
XMAX= 72.0
YMAX= 14.0
ZMAX= .0

DATE:SEP 20,1999
TIME: 14:35:50



DRAW JOINT MEMB SUPP PROP

```
48. DRAW LOAD 1 VAL
```

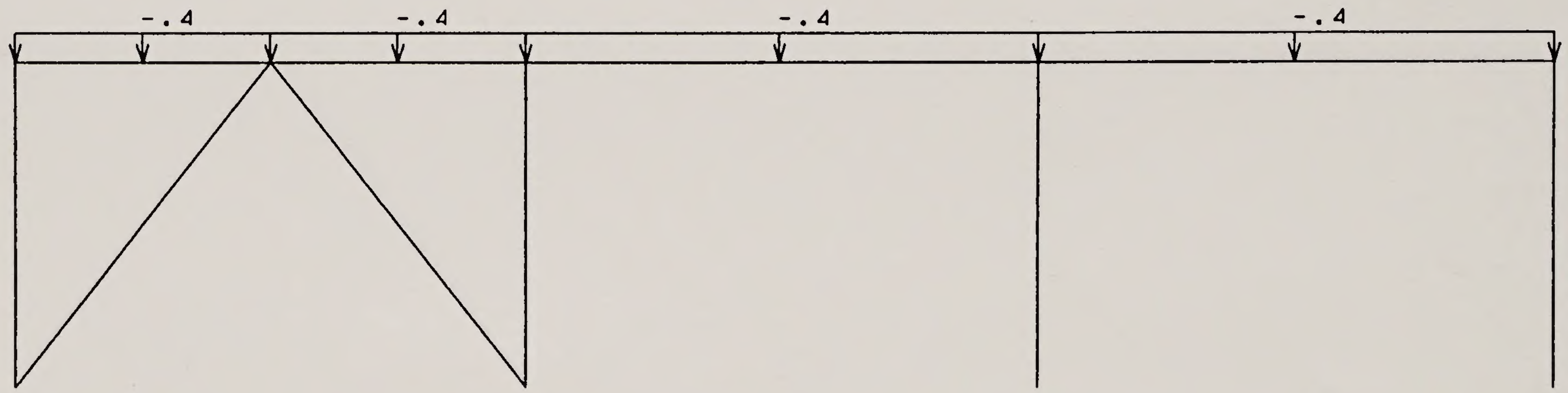
S T A A D -III
REV: 22.3a

STRUCTURE DATA:

TYPE = PLANE
NJ = 9
NM = 10
NE = 0
NS = 4
NL = 2
UNIT FEET KIP
XMAX= 72.0
YMAX= 14.0
ZMAX= .0

DATE:SEP 20,1999
TIME: 14:35:50

LN= 1



DRAW LOAD 1 VAL

```
49. DRAW LOAD 3 VAL
```

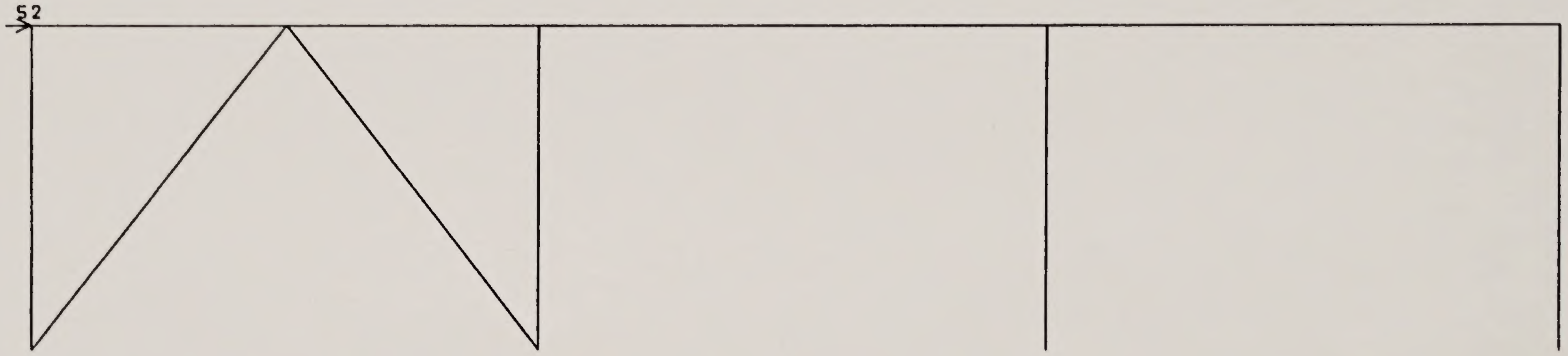
S T A A D -III
REV: 22.3a

STRUCTURE DATA:

```
TYPE = PLANE
NJ =       9
NM =      10
NE =       0
NS =       4
NL =       2
UNIT FEE   KIP
XMAX=     72.0
YMAX=     14.0
ZMAX=       .0
```

DATE:SEP 20,1999
TIME: 14:35:50

LN= 3



DRAW LOAD 3 VAL

```
50. FINISH


     *************** END OF STAAD-III ***************

       *
```

Appendix H -- Cost Estimate

CODE: D 8170

ESTIMATE WORKSHEET

SHEET 1 OF 1

FEATURE: **FEMA 310 SEISMIC EVALUATIONS** NONSTRUCTURAL	PROJECT: BLM Boise District Office , ID
	DIVISION / REGION: CIVIL ENGINEERING
	CONTRACT/SPEC: Appraisal Level Cost Estimate
WOID: ER900	FILE: I:\PROJ\FEMA310\BLM\BOISEDOE.WK4

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		See Report Sections 6.2 and 9.2	D8120	28,890	SF	$3.30	$95,337.00
		Bldg. Section 2 (168'x72'x2 story) = 24,190					
		Bldg. Section 1 (84'x56') = 4,700					
		Location Factor [commercial]	Ada County, ID ZIP: 83705			0.91	$86,756.70
		Mobilization	+/-			5%	$4,340.00
		SUBTOTAL					$91,096.70
		Unlisted Items	+/-			10%	$8,903.30
		Estimated Contract Cost					$100,000.00
		Contingencies	+/-			20%	$20,000.00
		Estimated Field/Project Costs					$120,000.00
		The unit cost is per ICSSC TR-17 Handbook.					

QUANTITIES		PRICES	
BY Tom Graber	APPROVED R Barthel Rodney Barthel	BY D-8170	CHECKED
DATE PREPARED 20-Sep-99	DATE 20-Sep-99	DATE	PRICE LEVEL